NUCLEAR SCIENCE ABSTRACTS

Volume 11 September 30, 1957 No. 18A

GENERAL

9904
FIRST ANNUAL GUIDED MISSILE ENCYCLOPEDIA, 1957. Missiles and Rockets 11, No. 7, 123-64(1957) July.

The guided missiles now being tested and in production for the U. S. Army, Navy, and Air Force are described. (W.L.H.)

ATOMIC BOMBS AND WARFARE

9905 WT-1175
Liquefied Petroleum Gas Assn., Chicago and Federal Civil Defense Administration, Battle Creek, Mich.
EFFECTS OF A NUCLEAR EXPLOSION ON TYPICAL LIQUEFIED PETROLEUM GAS (LP GAS) INSTALLATIONS AND FACILITIES. Paul W. Tucker and George R. Webster. Dec. 1956. 45p. Project 35.4a [of] OPERATION TEAPOT. $0.35(OTS).

9906 WT-1180
Sandia Corp., Albuquerque, N. Mex.
THE EFFECTS OF NOISE IN BLAST-RESISTANT SHELTERS. F. G. Hirsch, Joan Longhurst, D. R. McGiboney, and H. H. Sander. May 1956. 43p. Project 33.2 [of] OPERATION TEAPOT. $0.30(OTS).

A fatigue syndrome has been observed to develop in animals that experience a nuclear explosion while confined in a blast-resistant shelter. In order to determine the importance of noise as a contributing factor, groups of deafened and nondeafened albino male rats were placed in blast-resistant shelters on two explosions of the Operation Teapot series. Noise measurements were made which showed that noise intensities reached a level as high as 181 db, but only for durations of 35 msec. No differences were found between the deafened and nondeafened rats in the postshot experimental tests. It was concluded that noise in this particular instance was not a parameter of importance in the etiology of fatigue. Many of the animals received significant doses of ionizing radiation. This affected the learning performance of the untrained animals; however, it did not affect the retention of a learned response in the case of the animals that had been trained prior to the explosion. Despite the fact that these trained rats were very ill, they continued to perform the discriminatory act without error. (auth)

ATOMIC POWER

9907
THE FUTURE FOR NUCLEAR POWER. Christopher Hinton. Atomics 8, 258-61(1957) July.

The development of nuclear power in Great Britain is reviewed, and the cost of power from present reactors is compared with conventional power plants. (T.R.H.)

9908
ATOMIC ENERGY IN CZECHOSLOVAKIA. Atomics 8, 265-6(1957) July.

9909
SOUTH AFRICA'S PROGRAMME. W. L. Speight. Atomics 8, 267(1957) July.

9910
ENGINEERING PROBLEMS OF NUCLEAR POWER. 3. Claude D. Gibb (C. A. Parsons and Co., Ltd., Newcastle upon Tyne). Atomics 8, 271-5(1957) July.

9911
CHEMISTRY AND TECHNOLOGY OF NUCLEAR MATERIALS AT THE GENEVA CONFERENCE UPON THE PEACE-TIME USES OF ATOMIC ENERGY. M. A. Rollier. Chimica e industria (Milan) 38, 20(1956) Jan. (In Italian)

The author gives a brief evaluation of the Geneva International Conference on the peaceful uses of atomic energy from the point of view of the declassification of valuable technical and scientific information. Referring to nuclear materials both as to the building materials of a nuclear reactor and as the materials formed inside a reactor during its operation, a summary is given of the chemistry of the heavy elements as it has been discussed at Geneva. Particular reference is made to Np, Pu, and the transplutonium elements, as well as to the chemistry of the fission products. Radiation damage to metals and to graphite is reviewed, and the report on nuclear technology at Geneva ends with an appraisal of heavy water, Be, and nuclear grade Zr production. (tr-auth)

BIOLOGY AND MEDICINE

9912 UR-482
Rochester, N. Y. Univ. Atomic Energy Project.
A STUDY OF GENE ACTION IN ULTRAVIOLET-IRRADIATED BACTERIOPHAGE. David R. Krieg. Apr. 9, 1957. 80p. Contract W-7401-eng-49. $0.50(OTS).

9913
SHORT-TERM PRESERVATION OF MOUSE BONE MARROW AT REFRIGERATION AND ROOM TEMPERATURE FOR IRRADIATION EXPERIMENTS. Irene S. Urso and C. C. Congdon (Oak Ridge National Lab., Tenn.). J. Appl. Physiol. 10, 314-16(1957) Mar.

9914
PHYSICS AND MEDICINE. Roland Herrmann. Strahlentherapie 103, 149-57(1957). (In German)

The need for close collaboration of physical and medical scientists in dealing with problems of radiotherapy is stressed. (C.H.)

RADIATION EFFECTS

9915 NP-6334
Chicago. Univ. Air Force Radiation Lab.
QUARTERLY PROGRESS REPORT NO. 23. Apr. 15, 1957. 99p. Contract AF41(657)-25.

Progress is reported on studies on the effects of ionizing radiations on the biochemistry of mammalian tissues, the effectiveness of pharmacological and toxicological compounds as protective or therapeutic agents against radia-

tion injury in experimental animals, and the influence of exposure to low levels of γ and fast neutron irradiation on the life span of mice. Data are included from studies on the effects of S, β-aminoethylisothiuronium dichloride and β-mercaptoethylamine on sulfhydryl enzymes and on the adenosine triphosphatase activity of the hematopoietic tissues of irradiated animals; the injurious effects of acutely toxic doses of x irradiation following daily exposure to low doses of x ray; the influence of twenty-seven chemical compounds on radiation lethality in mice; and preliminary results from studies on the effects of chronic exposure of mice to neutron and γ irradiation. (For preceding period see NP-6199.) (C.H.)

9916 UCRL-3758

California. Univ., Berkeley. Radiation Lab.
BIOLOGY AND MEDICINE QUARTERLY REPORT [FOR] JANUARY, FEBRUARY, MARCH 1957. Apr. 19, 1957. 37p. Contract W-7405-eng-48. $0.30(OTS).

Progress is reported in the following studies: the morphology of an osteogenic sarcoma transplantable in rats; the metabolism of Ca^{45} in an osteogenic sarcoma; the induction of mammary tumors in rats following the injection of At^{211}; radioinduced changes in oxygen-saturated pepsin solutions and aqueous glycine solutions; and the development of chemical radiation detectors. Health chemistry problems and health physics activities for the period are summarized. (For preceding period see UCRL-3653.) (C.H.)

9917

REGENERATION AND MALFORMATION IN THE NERVOUS SYSTEM, EYE, AND MESENCHYME OF THE MAMMALIAN EMBRYO AFTER RADIATION INJURY. Samuel P. Hicks, Barbara L. Brown, and Constance J. D'Amato (New England Deaconess Hospital and Harvard Medical School, Boston, Mass.). Am. J. Pathol. 33, No. 3, 459-81(1957).

9918

COMPARISON OF ACUTE PATHOLOGICAL EFFECTS OF ALPHA AND BETA-PARTICLE RADIATION OF RAT THYROID. Stuart W. Lippincott, Claire J. Shellabarger, and Johan K. Basson (Brookhaven National Lab., Upton, N. Y.). Arch. Pathol. 63, 557-61(1957) June.

9919

GONAD RADIATION DOSE FROM DIAGNOSTIC PROCEDURES. G. M. Ardran and H. E. Crooks (A.E.R.E., Harwell). Brit. J. Radiol. 30, 295-7(1957) June.

The gonad doses received by male and female patients during diagnostic procedures were estimated, and the effect of reducing the leakage radiation and scatter is demonstrated. (auth)

9920

THE RELATIVE BIOLOGICAL EFFICIENCY OF 4 Mev AND 300 kv RADIATIONS. A REPORT FROM THE "MEDICAL RESEARCH COUNCIL" UNIT, CHRISTIE HOSPITAL AND HOLT RADIUM INSTITUTE, MANCHESTER. Brit. J. Radiol. 30, 337-55(1957) July.

9921

CHANGES IN DEOXYRIBOSIDE, DEOYRIBOTIDE AND NUCLEIC ACID CONTENT OF RABBIT APPENDIX AND THYMUS AFTER X IRRADIATION. C. W. Bishop and J. N. Davidson (The Univ., Glasgow). Brit. J. Radiol. 30, 367-70(1957) July.

9922

THE EFFECT OF DEHYDRATION UPON THE FREQUENCY OF X-RAY-INDUCED CROSSOVER-LIKE EXCHANGES IN OÖCYTES AND OÖGONIA. Irwin H. Herskowitz. Drosophila Information Service 30, 118-19(1956).

Experiments were made to determine whether x-ray induced cross-over-like exchanges in oöcytes and oögonia were sensitive to prior dehydration of mothers and to test whether the dehydration effect on the egg mortality produced by radiation has a genetic basis. (R.V.J.)

9923

BIOLOGICAL EFFECTS OF IONIZING RADIATION IN THE LIGHT OF PRESENT VIEWS ON THE NATURE OF DNA. A. M. Kusin (Inst. of Biophysics Acad. of Sciences U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser. Biol. 273-84 (1957) May-June. (In Russian)

9924

EFFECT OF GAMMA IRRADIATION ON THE DESOXYRIBONUCLEASE II ACTIVITY OF ISOLATED MITOCHONDRIA. Shigefumi Okada and Lee D. Peachey (Univ. of Rochester School of Medicine and Dentistry, N. Y.). J. Biophys. Biochem. Cytol. 3, No. 2, 239-48(1957) Mar.

9925

DIRECT AND INDIRECT EFFECTS OF X-RADIATION ON ANTIBODY-PRODUCING CELLS. Frank J. Dixon, James C. Roberts, and William O. Weigle (Univ. of Pittsburgh School of Medicine). J. Exptl. Med. 105, No. 5, 417-24 (1957) May.

X-radiation appears to exert its inhibitory effect on the antibody response by direct radiation injury to the antibody-producing lymphoid tissue, and by indirect effects of altered homeostasis in the radiated host on antibody-producing tissues. Neither of these two effects alone produces significant inhibition of the secondary antibody response made by transferred lymphoid cells. However, 400 to 500 r administered in vitro to the transferred cells, plus 400 r whole body x-radiation of the recipient prior to transfer, completely inhibited the antibody response in rabbits. (auth)

9926

THE EFFECTS OF IONIZING RADIATION ON THE INTROCEPTIVE UNCONDITIONED REFLEXES. E. I. Komarov (Central Research Roentgen-Radiological Inst.). Med. Radiol. 2, No. 3, 3-8(1957) May-June. (In Russian)

9927

EFFECTS OF REPEATED EXPOSURES TO IONIZING RADIATION ON THE DEVELOPMENT OF ADAPTATION REACTIONS. Yu. K. Kudritskii (Central Research Roentgen-Radiological Inst.). Med. Radiol. 2, No. 3, 8-13 (1957) May-June. (In Russian)

9928

CHANGES IN LYMPHOID TISSUE OF SPLEEN IN MICE FOLLOWING THE EXPOSURE TO γ RADIATION. (Sechenov Inst. of Evolutionary Physiology). Med. Radiol. 2, No. 3, 14-19(1957) May-June. (In Russian)

9929

ON THE CONTENT OF HYALURONIDASE AND HYSTAMINE IN BLOOD OF PERSONNEL EXPOSED TO IONIZING RADIATION DURING THE WORK. E. P. Stepanyan, V. S. Klemov, and N. I. Gorbarenko (Inst. of Therapy Acad. of Med. Science U.S.S.R.). Med. Radiol. 2, No. 3, 19-23 (1957) May-June. (In Russian)

9930

REMOTE EFFECTS OF SINGLE DOSES AND CHRONIC UPTAKE OF RADIOACTIVE ISOTOPES (Ce^{144}, Ru^{106}, Sr^{89}, and Sr^{90}) BY GASTRO-INTESTINAL TRACK. V. N. Strel'tsova and Ya I. Moskalev. Med. Radiol. No. 3, 23-34 (1957) May-June. (In Russian)

Studies were made of the biological effects induced by Sr^{89}, Sr^{90}, Ce^{144}, and Ru^{106} in single doses and continuous (100 days) uptake by the gastro-intestinal tract in quantities exceeding the maximum permissible doses in 1, 2, and 3 order. Experiments were made with 264 rats which perished in 200 days after the introduction of the radio-

active isotopes. During the continuous and single radioisotopic uptake by intestinal tract the maximum swellings developed with the doses exceeding the order 2 to 3. The radiation sickness without the swellings was expressed by ulcerated enteritis of the colon with localizations in caecum, rectum, and colon (Ce^{144}, Ru^{106}), by chronic inflammation in the oral area with injuries to the jaws, fragility and friability of bones (Sr^{89}, Sr^{90}, and Ce^{144}), and by obesity, gangleon periarteritis, and nephrosclerosis (Ru^{106}). (R.V.J.)

9931

EXPERIMENTAL INVESTIGATION OF THE EFFECT OF TOTAL RADIATION ON THE ANIMAL ORGANISM BY CONTINUOUS RADIATION OF LETHAL DOSES. H. Braun. Oncologia 10, 272-80(1957). (In German)

Animal experiments are reported with white rats, and the lethal x-ray dose established. Before the lethal dose was given, preliminary radiation was given at various intervals, and with various doses (200, 350, and 500 r), in order to examine how far this affects the animal regarding the second, lethal dose, radiation. Apart from a dose factor with greater intervals, it could be shown that the animals which had two radiations died earlier than the animals which only had the lethal dose. This means that the animal is adversely affected by a preliminary radiation, and it must be assumed that in these cases a cumulation of the damage, caused by x radiation, occurs. The question is also discussed, if smaller doses with the preliminary radiation might produce different results. (auth)

9932

THE RESPONSE OF SEX-BOUND LETHAL FACTORS IN DROSOPHILA MELANOGASTER TO IRRADIATION BY 30 Mev ELECTRONS AND 180 kev X-RAYS. A. J. Shenfield. Oncologia 10, 281-94(1957) (In German)

The relative effects of 180-kev conventional rays and of fast 30-Mev electrons, both at 3,000 r, were investigated on immature male germ cells of Drosophila melanogaster which were irradiated 5 to 11 days before fertilization. The "Muller-5 method" was employed, and the lethal and sublethal factors resulting in the F_2 generation were counted. Using fast electrons, 6.07% lethal factors were obtained, compared to 5.18% with conventional rays, i.e., the mutagenic effect of fast electrons was 1.17 times stronger. This difference, however, could not be verified statistically. The number of sublethal factors produced was too minute for quantitative evaluation. It may be presumed from the experiments that fast 30-Mev electrons possibly have a stronger mutagenic action than 180-kev roentgen rays, but further tests are required before definite conclusions can be drawn. (auth)

9933

THE EFFECT OF X-RAYS ON THE DROSOPHILA TESTIS AND A METHOD FOR OBTAINING SPERMATOGONIAL MUTATION RATES. W. J. Welshons and W. L. Russell (Oak Ridge National Lab., Tenn.). Proc. Natl. Acad. Sci. U. S. 43, 608-13(1957) July.

Histological observations were made on the testes of irradiated adult Drosophila males. These experiments indicate that both secondary spermatogonia and young spermatocytes are sensitive to the killing effects of x rays. The destruction of these sensitive cells results in a period of temporary sterility following irradiation of adult males. Therefore, this sterile period can be relied upon to separate cells irradiated as spermatogonia from those irradiated at a later spermatogenic stage. It follows that radiation-induced spermatogonial mutations, uncontaminated by mutations at later stages in spermatogenesis, can be obtained from irradiated adult Drosophila males in much the same way that they have been obtained from male mice. (auth)

9934

THE EXPERIMENTAL INDUCTION OF GYNOGENESIS IN THE MOUSE. I. IRRADIATION OF THE SPERM BY X-RAYS. R. G. Edwards (Inst. of Animal Genetics, Edinburgh). Proc. Roy. Soc. (London) B146, 469-87(1957) June.

9935

THE EXPERIMENTAL INDUCTION OF GYNOGENESIS IN THE MOUSE. II. ULTRA-VIOLET IRRADIATION OF THE SPERM. R. G. Edwards (Inst. of Animal Genetics, Edinburgh). Proc. Roy. Soc. (London) B146, 488-504(1957) June.

9936

EFFECT OF SMALL MEASURED DOSES OF RADIATION ON LYMPHOCYTE MORPHOLOGY IN MAN. R. Lowry Dobson and Mary M. Chuff (Univ. of California, Berkeley). Proc. Soc. Exptl. Biol. Med. 95, 360-1(1957) June.

9937

FAILURE TO TRANSMIT RADIATION-INDUCED EARLY HYPOTENSION IN RABBITS CONNECTED THROUGH CONTROLLED CROSS-TRANSFUSION. Herbert B. Gerstner (Randolph Air Force Base, Texas). Proc. Soc. Exptl. Biol. Med. 95, 448-50(1957) July.

A pump for continuous cross-transfusion has been developed, and some studies about the nature of the early blood pressure fall induced in rabbits by x irradiation have been conducted. Results of the cross-transfusion experiments indicate that the shielded animal does not protect its partner exposed to 900 r, neither does the irradiated rabbit affect the blood pressure of the shielded partner. (auth)

9938

DELAYED EFFECTS OF IONIZING RADIATION. Charles E. Dunlap (Tulane Univ., New Orleans, La.). Radiology 69, 12-17(1957) July.

9939

GENETIC CONSIDERATIONS IN ESTABLISHING MAXIMUM RADIATION DOSES. James F. Crow (Univ. of Wisconsin, Madison). Radiology 69, 18-22(1957) July.

9940

CONSIDERATIONS BEARING ON PERMISSIBLE ACCUMULATED RADIATION DOSES FOR OCCUPATIONAL EXPOSURE. G. Failla. Radiology 69, 23-9(1957) July.

9941

GENETIC TRANSITION AS A DETERMINANT OF PHYSIOLOGIC AND RADIOLOGIC AGING AND OTHER CONDITIONS. Paul S. Henshaw (U. S. Atomic Energy Commission, Washington). Radiology 69, 30-6(1957) July.

9942

DEPENDENCE OF ACUTE RADIOSENSITIVITY ON AGE IN ADULT FEMALE MOUSE. George A. Sacher (Argonne National Lab., Lemont, Ill.). Science 125, 1039-40(1957) May 24.

9943

RADIOACTIVITY OF PEOPLE AND FOODS. Ernest C. Anderson, Robert L. Schuch, William R. Fisher, and Wright Langham (Los Alamos Scientific Lab., N. Mex.). Science 125, 1273-8(1957) June 28.

Measurements of the Cs^{137} content of people and of foodstuffs indicate that this nuclide is unlikely to be a decisive factor in the long-term hazards from weapons testing and reactor waste disposal. The amount of Cs^{137} now present in the population of the United States averages 0.006 microcurie and shows no marked dependence on geographic location. The average radiation dose received from Cs^{137} is one-twentieth of that received from natural radiopotassium and 1 percent of the average total dose from all natural sources. Because of the short biological half-life of cesium of about 140 days, it does not accumulate in the body as

does Sr^{90}. The study of the distribution of Cs^{137} is being continued to furnish information on the mechanisms of the fallout process and provide a measure of the rate of fallout and of stratospheric storage. (auth)

9944

PROTECTIVE EFFECT OF SMALL RADIATION DOSES AGAINST SUBSQUENT MASSIVE RADIATION. Hans-Joachim Heite and Dieter Tenhaeff. Strahlentherapie 103, 115-24(1957). (In German)

The possible protective effect of a preliminary radiation with x-ray minimum doses against injuries to tissues caused by a subsequent x-ray radiation with higher doses, was tested by means of the punch-hole rabbit ear test. (auth)

9945

BIOLOGICAL AND CHEMICAL EFFECTS OF RADIATION. M. Haissinsky, ed. Paris, Masson and Company, 1956. 228p. (In French)

A series of three lectures is presented covering the physical, chemical, and biochemical aspects of the actions of radiations on aqueous solutions. Measuring methods are discussed, and tables of conversion factors are appended. (648 references.) (C.H.)

9946

LEUKAEMIA AND APLASTIC ANEMIA IN PATIENTS IRRADIATED FOR ANKYLOSING SPONDYLITIS. MEDICAL RESEARCH COUNCIL SPECIAL REPORT SERIES NO. 295. W. M. Court-Brown and R. Doll. London, Her Majesty's Stationery Office, 1957. 141p. $1.89.

Refer also to abstracts 10028 and 10029.

RADIATION HAZARDS AND PROTECTION

9947 NYO-2065

New York Operations Office. Health and Safety Lab., AEC.

MEASUREMENT OF THE SCATTER COMPONENT FROM A KILOCURIE COBALT-60 SOURCE. Leonard R. Solon, Keran O'Brien, and Hugo Di Giovanni. June 10, 1957. 14p. $0.20(OTS).

In order to evaluate the scatter contribution to the dose rate from a distributed source over an extended plane, an experiment was performed using approximately 2 kilocuries of Co^{60} as the source and a Failla-Rossi tissue equivalent ionization chamber as the detector. Corroborative measurements of dose rate were made with a graphite-walled CO_2 filled ionization chamber. The point source measurements were numerically integrated over the plane to obtain the relative contribution of scatter to the total radiation. (auth)

9948 UR-488

Rochester, N. Y. Univ. Atomic Energy Project.

SOME EFFECTS OF THICKNESS OF THE LAYER IN PROTECTION AGAINST FLASH BURNS BY CREAMS. F. W. Payne and J. R. Hinshaw. Apr. 25, 1957. 16p. Contract W-7401-eng-49. $0.20(OTS).

9949 UR-489

Rochester, N. Y. Univ. Atomic Energy Project.

PROTECTION FROM RADIANT THERMAL ENERGY BY FABRICS USED AS A SHIELD. F. W. Payne, J. R. Hinshaw, and H. E. Pearse. May 3, 1957. 11p. Contract W-7401-eng-49. $0.15(OTS).

9950

THE NATURAL PROTECTION OF SHEEP FROM EXTERNAL BETA RADIATION. C. C. Lushbaugh and John F. Spalding (Los Alamos Scientific Lab., N. Mex.). Am. J. Vet. Research 18, 345-61(1957) Apr.

In April and May of 1953 sheepmen, wintering sheep north of the Nevada Proving Grounds, attributed heavy losses in their flocks to residual radiation from the atomic tests of that spring. Local veterinarians were unable to determine the cause of the malady which was manifest by progressive stages of erythema, desquamation, and papule and pustule formation on the face, ears, sides, and back. The loss of hair about the muzzle and the tips of the ears with ulceration and crust formation was suggestive of radiodermatitis. An extended study led to a diagnosis of infectious pustular dermatitis. During the study it was determined that the threshold dose for radio-induced epilation of sheep skin ranged from 2,500 to 15,000 rep, depending on the thickness of the wool. (C.H.)

9951

RADIOACTIVE FALLOUT FROM ATOMIC WEAPONS. F. C. Pace (Department of National Health and Welfare, Ottawa). Behind the Headlines 16, No. 5, 1-12(1956) Nov. $0.20.

Data on the subject of atomic weapon fall-out for the past two years are summarized. (R.V.J.)

9952

CIRCULATING RAT PLATELETS IN LETHALLY X-RADIATED MICE GIVEN RAT BONE MARROW. L. H. Smith, T. Makinodan, and C. C. Congdon (Oak Ridge National Lab., Tenn.). Cancer Research 17, 367-9(1957) June.

Circulating platelets of lethally irradiated mice given injections of rat bone marrow were tested with species-specific antiplatelet sera. Rat platelets were detected in the peripheral blood of treated mice at various intervals from 7 to 114 days after treatment. The 100 per cent rat platelet level was attained in some mice by the 14th day and in all mice by the 20th day. The results indicate that platelet precursors implant and produce functional platelets in irradiated mice given injections of rat bone marrow. (auth)

9953

NUCLEAR SAFETY CONSIDERATIONS IN REPROCESSING PLANT DESIGN. Norman Ketzlach (General Electric Co., Richland, Wash.). Chem. Eng. Progr. 53, 357-60 (1957) July.

Some of the nuclear safety aspects of the design and operation of reactor fuel separations plants are presented. The primary purpose is to acquaint those desirous of entering the spent reactor fuel processing business with some of the problems that must be considered in the design and operation of such a plant. (auth)

9954

HEALTH PHYSICS INSTRUMENTATION FOR A POWER REACTOR. G. H. Whipple (Univ. of Rochester, N. Y.). Elec. Eng. 76, 606-11(1957) July.

Health physics instrumentation for a representative power reactor is suggested, based on the measurements required, the required ranges and accuracies, and classes of instruments and their application. (M.H.R.)

9955

AFTER EFFECTS OF NUCLEAR RADIATION. Hermann J. Muller. J. Am. Soc. Safety Engrs. 1, 42-8(1956) Aug.

9956

CLOSE-IN FALLOUT. W. W. Kellogg, R. R. Rapp, and S. M. Greenfield (RAND Corp., Santa Monica, Calif.). J. Meteorol. 14, No. 1, 1-8(1957) Feb.

The phenomenon of radioactive fall-out from an atomic explosion is described, and a quantitative technique for determining the distribution of radioactive material on the ground is developed. The primary factors which must be considered are wind field, yield, and height of burst, and

particle-size distribution. Certain parameters which enter directly into a fall-out determination are given quantitatively, such as the altitude and size of the atomic cloud (as a function of explosion yield and atmospheric stability) and particle fall-rates (as a function of altitude and particle size). Two hypothetical fall-out patterns for a one-megaton explosion, computed on a high-speed digital computer are presented, showing the large effect which the wind has in determining the character of the fall-out. The meteorological problems associated with a fall-out prediction are discussed. (auth)

9957

RAIN SCAVENGING OF RADIOACTIVE PARTICULATE MATTER FROM THE ATMOSPHERE. S. M. Greenfield (RAND Corp., Santa Monica, Calif.). J. Meteorol. 14, No. 2, 115-25(1957) Apr.

9958

X-RAY RADIATION HAZARD USING VACUUM DEPOSITION PLANT. L. Holland (Edwards High Vacuum, Ltd., Crawley, Sussex). Nature 180, 89(1957) July 13.

9959

BASIC HEALTH PHYSICS. 2. D. E. Barnes (AWRE, Aldermaston). Nuclear Power 2, 294-7(1957) July.

The maximum permissible level for exposure to radiation from external sources is presented. Radiation output from various types of sources, dosage measurement, protection from external radiation, and surveys and area monitoring are included. (J.E.D.)

9960

STRONTIUM 90 IN NORTH ATLANTIC SURFACE WATER. Vaughan T. Bowen and T. T. Sugihara (Woods Hole Oceanographic Inst. and Clark Univ.). Proc. Nat'l. Acad. Sci. U. S. 43, 576-80(1957) July.

Results from Sr^{90} analyses of 5 sea water samples taken from the Atlantic coastal shelf are given. Some discrepancies in the values are explained. (T.R.H.)

9961

"SPLEEN PROTECTION" IN GAMMA- AND NEUTRON-IRRADIATED MICE. Howard H. Vogel, Jr., John W. Clark, Donn L. Jordan, Nicholas Bink, and Richard R. Barhorst (Argonne National Lab., Lemont, Ill.). Proc. Soc. Exptl. Biol. Med. 95, 409-12(1957) June.

9962

PATIENT EXPOSURE TO IONIZING RADIATION IN DENTAL RADIOGRAPHY. Norman A. Baily (Roswell Park Memorial Inst., Buffalo, N. Y.). Radiology 69, 42-5 (1957) July.

9963

THYROID RADIOACTIVITY AFTER NUCLEAR WEAPONS TESTS. C. L. Comar, Bernard F. Trum, U. S. G. Kuhn, III, R. H. Wasserman, M. M. Nold, and J. C. Schooley (Oak Ridge Inst. of Nuclear Studies, Tenn.). Science 126, 16-18 (1957) July 5.

The information collected on the levels of I^{131} in human and cattle thyroids and the estimate of milk levels in the U. S. A. during the period from 1955 to 1956 are summarized. Correlations with bomb test fall-out and deductions about routes of exposure are presented. (R.V.J.)

9964

EFFECT OF A CONTINUED DOSE OF CORTISONE AND ANTIBIOTICS ON X-RAY INDUCED LUNG LESIONS OF THE RAT. Hans Cottier. Strahlentherapie 103, 77-90 (1957). (In German)

Following irradiation of a pulmonary field cortisone with or without penicilline and streptomycine was daily administered to rats for a period of 4 months. Small dosages of cortisone had no significant effect on the x-ray induced pulmonary lesions. Larger dosages of cortisone decreased the incidence of fibrosis but deteriorated the final result by promoting mortality, the development of acute pneumonia, purulent bronchitis, atypical epithelial proliferations, edema and pulmonary necrosis. Radiologically detected postirradiative pulmonary densities always persisted except for few animals, in which the radiological changes of the lungs temporarily disappeared while under antibiotic treatment. Postirradiative pulmonary mycosis developed in 2 animals treated with cortisone and antibiotics. (auth)

9965

THE EFFECT OF HISTAMINE ON THE TOTAL BODY IRRADIATION WITH HIGH DOSE X-RADIATION. V. Várterész and E Kálmán. Strahlentherapie 103, 129-32(1957). (In German)

Pretreatment with histamine offered no protection to rabbits and guinea pigs exposed to lethal doses of x radiation. (C.H.)

9966

PROTECTION AGAINST RADIATIONS. A. Claude, S. Simon, P. Kipfer, and Z. Bacq. Mons, France, Delporte Establishment, [1956]. 224p. (In French)

The recommendations for radiation protection of the U. S. Bureau of Standards and the International Commission for Protection Against Radiation are included in this survey. The subject matter is divided into parts entitled: security measures regarding radiation sources, security measures regarding radioisotopes, and special study of particular cases (radioiodine, radiophosphorus, radiogold, and radiocarbon.). Neutrons, high-voltage apparatus, and radiation measuring instruments and control are to be considered in a future publication. (T.R.H.)

Refer also to abstracts 10173 and 10191.

RADIATION SICKNESS

9967

THE ROLE OF INFECTION IN ILLNESS FOLLOWING EXPOSURE TO ACUTE TOTAL BODY IRRADIATION. V. P. Bond (Brookhaven National Lab., Upton, N. Y.). Bull. N. Y. Acad. Med. 33, No. 5, 369-74(1957) May.

9968

ADRENALINE USES IN CONJUNCTION WITH ACETYLCHOLINE FOR PROPHYLAXIS OF RADIATION SICKNESS. L. F. Semenov and E. A. Prokudina (Central Research Roentgen-Radiological Inst.). Med. Radiol. 2, No. 3, 35-40(1957) May-June. (In Russian)

9969

STIMULATION OF HAEMOPOIESIS IN ACUTE RADIATION SICKNESS. V. B. Farber. Med. Radiol. 2, No. 3, 40-7 (1957) May-June. (In Russian)

RADIOTHERAPY

9970

THE MINERAL CONTENT OF BONE TUMORS AND ITS INFLUENCE ON RADIATION TUMOR DOSE. Helen Q. Woodard and Ralph Phillips (Sloan-Kettering Inst. and Memorial Hospital, New York). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 78, 109-15(1957) July.

9971

THE EFFECT OF "SHOCK" AND SHOCK-PRODUCING CHEMICALS ON NUCLEIC ACID SYNTHESIS IN RAT TUMORS. Barbara E. Holmes and Lorna K. Mee (Univ. Department of Radiotherapeutics, Cambridge). Brit. J. Radiol. 30, 305-10(1957) June.

The effects of severe ischaemic shock and of various

shock-producing and other chemicals on P^{32} uptake and on nucleic acid synthesis in the Jensen rat sarcoma were investigated. The possibility was considered that the apparent effect of x-ray irradiation on nucleic acid synthesis might be due, in part, to a slight degree of stress produced by the fastening of the animals under the x-ray applicator. When this complicating factor is avoided, it is found that a dose of 2000 r x rays causes a 50 per cent decrease in DNA synthesis in the Jensen rat sarcoma but has no effect on P^{32} uptake into RNA. (auth)

9972

THE MANCHESTER TRUNK BRIDGE FOR THE TREATMENT OF RADIOSENSITIVE TUMORS. E. C. Easson, J. B. Massey, B. E. Jones, and R. S. Pointon (Christie Hospital and Holt Radium Inst., Withington, Manchester). Brit. J. Radiol. 30, 311-17(1957) June.

The Manchester Trunk Bridge is a device to facilitate the homogeneous irradiation of large volumes of tissue. Its main clinical application is in the treatment of radiosensitive tumors of the head and neck, thorax, or abdomen. Its value lies in the ease with which predetermined isodose distributions can be reproduced in and around tumor areas. The data necessary for using this simple and versatile apparatus are discussed, as also are several useful modifications. (auth)

9973

PROTON IRRADIATION OF THE PITUITARY AND ITS METABOLIC EFFECTS. Rollin K. McCombs (Univ. of California, Berkeley). Radiology 68, 797-811(1957) June.

9974

DISTRIBUTION MEASUREMENT OF RADIOISOTOPES. PART I. Dietrich Frost and Werner Schumacher. Strahlentherapie 103, 133-8(1957). (In German)

An instrument is described which was designed to measure the distribution of radioactive colloidal substances administered for therapeutic purposes. (C.H.)

TOXICOLOGY STUDIES

9975 UR-487

Rochester N. Y. Univ. Atomic Energy Project. SPECIES DIFFERENCES IN THE METABOLISM OF POLONIUM^{210}. J. N. Stannard and F. A. Smith. Apr. 23, 1957. 14p. Contract W-7401-eng-49. $0.20(OTS).

The excretion of Po^{210} after intravenous injection has been compared for man, mouse, rat, dog, and rabbit, and the tissue distribution compared for rat, mouse, and rabbit. Some significant differences appear, viz., urinary excretion is much more rapid in the rabbit than in any other species; total excretion is slowest in the dog; rabbit tissues contain less Po per gram than other species while rat tissues contain the most; this is true also on a per organ basis with the exception of kidney where rabbit and mouse are slightly higher than rat; and mouse tissues retain Po more firmly over long periods than did those of the other species tested. On the basis of these results, calculations of maximum permissible body burden for man, using the critical organ concept, would be quite different if data for rabbit or dog were utilized, rather than rat or mouse. The behavior of Po in man appears to be more like that in the latter than in the former species. In general, kidney contents showed greater uniformity from species to species than did spleen, and choice of kidney for the critical organ may be indicated. (auth)

TRACER APPLICATIONS

9976

THE MEMBRANE FILTER TECHNIQUE IN RADIATION STUDIES OF SPORES OF BACILLUS MEGATERIUM. E. L. Powers, C. F. Ehret and Anne Bannon (Argonne National Lab., Lemont, Ill.). Appl. Microbiol. 5, No. 2, 61-4(1957) Mar.

A technique is described which utilizes membrane filters in the determination of the sensitivity of spores of Bacillus megaterium to x irradiation. Germination efficiency is affected by the composition and amount of medium used. In optimal circumstances 100% recoveries are routine. The spores, suspended in cold distilled water, retain colony-forming capacity for over two years. Variability in counts arises mostly from hand-pipetting manipulations. When most of these are eliminated from the procedure, highly reproducible radiation response curves can be obtained. These characteristically demonstrate small departures from simple exponential form. (auth)

9977

THE CONCENTRATION AND BINDING OF THYROXINE AND TRIIODOTHYRONINE BY RAT DIAPHRAGM. John R. Hogness, Norman D. Lee, Margaret K. Berg, and Robert H. Williams (Univ. of Washington School of Medicine, Seattle and Veterans Administration Teaching Group Hospital, Memphis, Tenn.). J. Clin. Invest. 36, 803-9(1957) June.

Studies of the uptake of I^{131}-labeled thyroxine by rat diaphragm as a function of incubation time, hormone concentration in the medium, and duration of rinsing, as well as equilibrium studies, are presented. When rat diaphragm was incubated in medium containing varying concentrations of thyroxine for increasing periods of time, the amount of the hormone bound was shown to be linearly related to the time of incubation at all concentrations. Similarly, a direct linear relationship between the amount of thyroxine available and the amount bound to tissue was demonstrated. Washout studies showed that, with prolonged rinsing, little thyroxine was removed from rat muscle after the first 15 minutes of rinsing. Equilibrium studies, wherein hemidiaphragms were incubated first with labeled thyroxine and then transferred to solutions containing unlabeled material, showed no significant loss of initial radioactivity during incubation with the non-radioactive thyroxine. All of these observations indicate that thyroxine is indeed specifically bound to rat muscle tissue in concentrations far exceeding those in the incubating medium. Similar incubation and washout studies were carried out with triiodothyronine. These studies showed not only that triiodothyronine was also specifically bound to rat muscle tissue but that this binding took place much more rapidly than in the case of thyroxine. When the hormone concentration was 1.3×10^{-4} μM per ml triiodothyronine-I^{131} was bound to rat diaphragm 2.5 times as rapidly as was thyroxine-I^{131}. This finding is in accord with previous observations regarding the relative rates of action of these two compounds in vivo. Comparison studies carried out with NaI^{131} showed that, in equimolar concentrations, relatively insignificant amounts of this compound were taken up by rat diaphragm and that which was absorbed was readily removed by washing. These investigations are discussed in relation to the mechanism of action of thyroxine and triiodothyronine. (auth)

9978

DISTRIBUTION OF RADIOSULFUR, S^{35}. I. IN THE HUMAN ADULT. II. IN THE YOUNG AND THE ADULT RAT. Charles W. Denko and Robert E. Priest (Argonne Cancer Research Hospital and Univ. of Chicago, Ill.). J. Lab. Clin. Med. 50, 107-12(1957) July.

Studies were made to delineate the distribution of S^{35} in various organs and in the connective tissue of human adults. The quantitative distribution of radioactive sulfur in tissues and organs of young and adult rats was also studied, and some evaluation of obtained data was given. (R.V.J.)

9979
DIFFERENTIAL REMOVAL OF STRONTIUM 85 AND CALCIUM 45 FROM RAT SKELETON BY PERITONEAL LAVAGE. Roy V. Talmage, J. C. Schooley, and C. L. Comar (Oak Ridge Inst. of Nuclear Studies, Tenn.). Proc. Soc. Exptl. Biol. Med. 95, 413-17(1957) July.

Refer also to abstract 10194.

CHEMISTRY

9980 AECU-3467
Oregon. Univ., Eugene.
ANODIC OVERPOTENTIAL FOR OXIDE-FREE ZIRCONIUM. Mario Maraghini, George B. Adams, Jr., and Pierre Van Rysselberghe. May 1, 1957. 13p. Contract [AT(45-1)-535]. $0.15(OTS).

The estimation of the potential that a polarized Zr anode would exhibit if it were free of oxide film is presented. (auth)

9981 AECU-3483
[Carborundum Metals Co., Inc., Akron, N. Y.]
PHTHALATE PRECIPITATION. Sept. 9, 1955. 6p. Contract [AT(11-1)-404]. (CM-14-D-1). $1.80(ph OTS); $1.80(mf OTS).

9982 AECU-3511
Michigan. Univ., Ann Arbor.
ALTERNATING CURRENT POLAROGRAPHY: AN IMPROVED EXPERIMENTAL ARRANGEMENT, EXAMINATION OF THE THEORY. STUDY OF THE Cd(II) SYSTEM. Report No. 25. Henry H. Bauer and Philip J. Elving. Apr. 1, 1957. 42p. Contract AT(11-1)-70, Project 8. $7.80(ph OTS); $3.30(mf OTS).

The technique of alternating current polarography employing an alternating potential of millivoltage amplitude has important potentialities for analysis and the study of electrode processes. The fundamental theoretical and experimental factors involved in the technique are critically reviewed. An experimental procedure is described, which overcomes most of the uncertainties previously connected with the use of a-c polarography. The data obtained on the reduction at the D. M. E. of Cd(II) in HCl solution have been used to test the validity of the theoretical treatment of a-c polarographic phenomena. These data yielded a value of the heterogeneous rate constant for the reaction specified of 0.165 cm/sec. The experimental and mathematical procedures are described in detail to facilitate use of the technique. (auth)

9983 BNL-418
Brookhaven National Lab., Upton, N. Y.
NUCLEAR ENGINEERING DEPARTMENT PROGRESS REPORT [FOR] NOVEMBER 15, 1955 - FEBRUARY 15, 1956. 29p. $0.25(OTS).

Values of buckling and reflector savings are given for boron-poisoned lattices of 0.387-in. diameter, 1.15% enriched U rods. Fast effect values for the same diameter rods in H_2O are given. The distribution of La between the fused-salt eutectic $MgCl_2-KCl-NaCl$ and a U-Bi-La alloy was measured. Further work with EMF concentration cells on the Na-Bi system has yielded activity coefficients for Na in the concentration range of 0 to 0.20 mole/fraction. These coefficients increase slightly with concentration and are of the order of 10^{-5}. On the basis of infrared spectra obtained on pure liquid samples of BrF_3, BrF_5, and UF_6, it appears that the Perkin-Elmer infrared analyzer can be used to provide continuous analysis of the circulating dissolver stream of the pilot plant for the Volatile Fluoride Process. The solubility of Ti in Bi is given by the equation $\log_{10}$ (ppm Ti) = 2250/T + 6.08. It is shown that the product of the solubilities of Cr and Fe is constant at a fixed temperature. (For preceding period see BNL-380.) (M.H.R.)

9984 HEC-77
Hooker Electrochemical Co., Niagara Falls, N. Y.
THE DIRECT REACTION OF CALCIUM FLUORIDE-BORON TRIFLUORIDE COMPLEX WITH ALUMINUM CHLORIDE. E. A. Belmore and A. M. Teller. Feb. 20, 1957. 16p. Contract AT-(30-1)-1524. $3.30(ph OTS); $2.40(mf OTS).

This reaction was investigated in order to provide temporary relief from the severe mechanical trouble which was experienced with the vapor phase BF_3-AlCl_3 reaction originally installed in the Boron Metal Plant. It was found that as much as 80% conversion to BCl_3 could be obtained by adding finely ground $AlCl_3$, in considerable excess, to the CaF_2-2BF_3 complex in an agitated vessel, and continuously heating the contents. Most of the additional 20% was driven off as unconverted BF_3. This could be collected on activated C adsorbers and later converted by desorbing through heated towers packed with $AlCl_3$. This work was discontinued when the electrolytic method of reduction was adopted, and BCl_3 was no longer required as feed material. It is still felt, however, that the vapor-phase type of reactor is the most sound approach to this problem, in spite of the severe mechanical problems inherent to it. (auth)

9985 NOLC-368
Naval Ordance Lab., Corona, Calif.
DEVELOPMENT OF THERMALLY STABLE POLYMERIC MATERIALS. Period covered: January 1954 through May 1956. Charles P. Haber. Apr. 18, 1957. 67p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF33(616)56-41. (WADC-TR-56-376).

Promising inorganic bonding systems for thermal and chemical resistance and incorporation of them into high polymer molecules were investigated. Diphenylvinylsilane was prepared and polymerized by means of free radical catalysts. These polymers, which resulted from the addition of an Si-H bond of one molecule across the unsaturation of another, were low-melting, brittle materials of mol. wt. 2,000 to 5,000. Attempts to increase the size of the molecules were unsuccessful. In an attempt to prepare $(CF_3)PN$ polymers, $(CF_3)_2PCl_3$ was synthesized in good yields by a multistep process. The conversion of $(CF_3)_2PCl_3$ to $(CF_3)_2PN$ by the action of NH_3 or NH_4Cl was unsuccessful due to unavoidable destructive side reactions. (auth)

9986 NYO-6676
Pennsylvania State Univ., University Park. Coll. of Mineral Industries.
AN INVESTIGATION OF THE CHEMICAL NATURE OF THE ORGANIC MATTER OF URANIFEROUS SHALES. Semi-annual Report Covering the period October 1, 1956 to March 31, 1957. Dept. of Fuel Technology. C. R. Kinney, R. L. Broadhead, J. T. Leonard, and T. J. Roessing. Apr. 30, 1957. 30p. Contract AT(30-1)-1442. $4.80(ph OTS); $2.70(mf OTS).

Work on air oxidation, ozonization, and solvent extraction has been continued. The work on solvent extraction has led to a study of chemical reactions of the organic matter in situ for the main purpose of removing it from the mineral grains of the shale, but also to learn more about its chemical structure and its association with the mineral matter. (auth)

9987 ORNL-2303
Oak Ridge National Lab., Tenn.
RADIOISOTOPE PRODUCTION AND PROCESS DEVELOPMENT ANNUAL REPORT FOR 1956. H.E. Seagren. July 11, 1957. 18p. Contract W-7405-eng-26. $0.20(OTS).

The main radioisotope production and process developments during the year 1956 are summarized. Chloroplatinic acid was investigated as a reagent for the final purification and recovery of fission product Cs^{137}. Cesium carried from simulated Arco wastes on 0.01M nickel ferrocyanide was studied for the best separation method. The reduction of Hg in Redox wastes was studied. Remotely operated shielded-arc welding for sealing stainless steel containers has been demonstrated successfully. (M.H.R.)

9988
BOND ENERGIES IN TRANSITION METAL COMPLEXES. F. Albert Cotton (Massachusetts Inst. of Tech., Cambridge). Acta Chem. Scand. 10, 1520-6(1956).

The feasibility of calculating the heat of formation of a gaseous complex ion, $MX_{p(g)}^{+m-px}$, from $M_{(g)}^{+m}$ and $pX_{(g)}^{-x}$ and hence the total bond energy by a procedure similar to the Born-Haber cycle is examined critically. It is concluded that at least in some cases the procedure has merit and application is made to some hexammines of divalent first transition series ions. Some implications of the results with regard to theories of the bonding in such complex ions are noted. (auth)

9989
INFRARED ABSORPTION SPECTRA OF INORGANIC COÖRDINATION COMPLEXES. XII. THE CHARACTERISTIC NH_3 DEFORMATION VIBRATIONS OF SOLID INORGANIC COMPLEXES. G. F. Svatos, D. M. Sweeny, San-ichiro Mizushima, Columba Curran, and J. V. Quagliano (Univ. of Notre Dame, Ind.). J. Am. Chem. Soc. 79, 3313-15(1957) July 5.

The infrared spectra of a number of solid metal amine complexes have been investigated. It has been possible to determine the three deformation vibrations of the ligated molecules in these complexes. The NH_3 degenerate deformation is observed in the region of 1650 to 1560 $cm.^{-1}$; the NH_3 symmetric deformation in the region of 1350 to 1150 $cm.^{-1}$; and the NH_3 rocking frequency in the region of 950 to 650 $cm.^{-1}$. Each of these absorption bands has a characteristic absorption profile. A theoretical explanation for the range of these deformation frequencies is presented. (auth)

9990
ANTIFERROMAGNETIC ORDERING AND ELECTRONIC STRUCTURE OF $CuCl_2 \cdot 2H_2O$ AS DETERMINED FROM NUCLEAR MAGNETIC RESONANCE. R. E. Rundle (Iowa State Coll., Ames). J. Am. Chem. Soc. 79, 3372-4(1957) July 5.

The nuclear magnetic resonance study of $CuCl_2 \cdot 2H_2O$ is coupled with neutron diffraction data on proton positions to obtain the type of antiferromagnetic ordering in $CuCl_2 \cdot 2H_2O$, and the distribution of the odd-electron in the $CuCl_2 \cdot 2H_2O$ "molecule." It is found that the odd-electron must be about 25% on each chlorine, 50% on copper. This distribution is consistent with a molecular orbital treatment of the complex, but not with crystal field theory or with Pauling's theory of directed valence in square copper complexes. The use of nuclear magnetic resonance in crystals as a probe for determining the distribution of magnetic electrons appears to be sensitive and deserving of further use. (auth)

9991
PREPARATION OF PURE FUSED LITHIUM CHLORIDE–POTASSIUM CHLORIDE EUTECTIC SOLVENT. H. A. Laitinen (Univ. of Illinois, Urbana), W. S. Ferguson (The Ohio Oil Co., Littleton, Colo.) and R. A. Osteryoung (Rensselaer Polytechnic Inst., Troy, N. Y.). J. Electrochem. Soc. 104, 516-20(1957) Aug.

Hydrolytic decomposition occurs during the fusion of a eutectic mixture of lithium chloride-potassium chloride containing traces of moisture if the fusion conditions are not controlled. The resultant contamination by hydroxyl ion greatly lowers the utility of this mixture as a fused salt solvent. The effectiveness of various procedures used for preparation of the fused salt solvent was followed by observation of the characteristic polarographic residual current using a platinum microelectrode. A preparative method is described which involves drying the mixture under moderate vacuum, fusion under anhydrous hydrogen chloride, and removal of the hydrogen chloride from the melt. (auth)

9992
REVIEW OF ARTICLES ON LUMINESCENCE FOR 1955-1956. Gorton R. Fonda. J. Electrochem. Soc. 104, 524-30 (1957) Aug.

9993
NEUTRON-DIFFRACTION STUDY OF THE MAGNETIC PROPERTIES OF PEROVSKITE-LIKE COMPOUNDS $LaBO_3$. W. C. Koehler and E. O. Wollan (Oak Ridge National Lab., Tenn.). J. Phys. Chem. Solids 2, 100-6(1957).

A neutron-diffraction study has been carried out on the series of compounds $LaBO_3$ in which B is a trivalent ion of one of the 3-d transition group elements Cr, Mn, Fe, Co, and Ni. Magnetic ordering transitions for $LaMnO_3$, $LaCrO_3$, and $LaFeO_3$ were found at Néel temperatures of 100°K, 320°K, and 750°K, respectively. The latter two compounds are found to order in a simple interpenetrating sublattice structure: $LaMnO_3$ as previously reported forms ferromagnetic layers which alternate in sign from layer to layer. No magnetic ordering, at temperatures down to 4.2°K, was observed for $LaCoO_3$ or $LaNiO_3$. (auth)

9994
THERMODYNAMICS OF MOLTEN MIXTURES OF ALKALINE METAL CHLORIDES AND THORIUM TETRACHLORIDE. W. V. Smirnov and L. E. Ivanovskiĭ (Sverdlovsk Electrochemical Lab. Acad. of Science). Zhur. Fiz. Khim. 31, 640-7(1957) Mar. (In Russian)

The equilibrium potentials of Th–Zn alloy electrode against a chlorine electrode were measured in molten eutectic mixtures of Li and K chlorides containing 2.98 to 40 × 16% by weight $ThCl_4$ and in pure molten $ThCl_4$ at 840°C. It was observed that melts with less than 25% by weight of $ThCl_4$ behave as ideal solutions. Equations were developed for the temperature and concentration dependence of the electrode potential Th/Th^{+4} in molten mixtures of alkaline metal chlorides of less than 25% by weight $ThCl_4$ with respect to the chlorine electrode. (R.V.J.)

9995
THE ELECTROCHEMICAL BEHAVIOR OF Ti IN AQUEOUS SOLUTIONS OF ELECTROLYTES. I. Hydrogen overpotential of titanium. Ya. M. Kolotyrkin and P. S. Petrov (Karpov Moscow Physico-Chemical Inst.). Zhur. Fiz. Khim. 31, 659-71(1957) Mar. (In Russian)

The hydrogen overpotential in Ti was measured over a wide range of current densities from 10^{-2} to 10^{-7} a/cm^2 and pH values from 1 to 14. (R.V.J.)

ANALYTICAL PROCEDURES

9996 AERE-C/R-607
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE DETERMINATION OF CERTAIN TRACE IMPURITIES

IN GRAPHITE BY RADIOACTIVATION. PART I. VANADIUM. A. A. Smales and D. Mapper. Dec. 1950. 19p.

A method is described for the analysis of V in graphite, involving no prior ashing of the sample and no chemical separations. The graphite sample is irradiated in the pile, together with a suitably chosen V standard, for 4 mins. At the end of this time, the activity due to the V in the sample and the standard is determined on the normal β-counting equipment, and the decay of the 3.7 minute ^{52}V is followed for several half lives. From the relative activities of sample and standard the percentage vanadium in the graphite is calculated. It is shown that, provided the graphite samples are homogeneous, reproducible results can be easily obtained. Alternatively, the method may be of use for determining the vanadium content of small samples of graphite, e.g., with a view to testing homogeneity. (auth)

9997 AERE-C/R-1045

Gt. Brit. Atomic Energy Research Establishment, Harwell, England.

THE ANALYSIS OF URANIUM–TUNGSTEN ALLOYS. G. W. C. Milner, L. Salmon, and A. F. Skewies. Nov. 1952. 18p.

A procedure is described for the analysis of U–W alloys containing up to 25% W. The W is selectively precipitated with 8-hydroxyquinoline from a solution of the alloy containing $H_2C_2O_4$ to complex the U and buffered to a pH value between 5 and 5.5. The W is finally determined by ignition to WO_3 at 800°C. The U is separated from the filtrate by precipitating with tannin at a pH of 8, the precipitate being removed by filtration and ignited at 800°C. The residue is dissolved in HNO_3, and the U is finally determined by precipitating as ammonium diuranate and igniting to U_3O_8. (auth)

9998 IGO-AM/W-92

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

THE DETERMINATION OF BORON IN METHANOL AND IN METHANOL DISTILLATES ARISING FROM BORON SEPARATION PROCEDURES. (CURCUMIN–OXALIC ACID METHOD). H. A. Wright. May 21, 1957. 7p.

The methanol is removed by evaporation, and B in the residue is determined absorptiometrically using curcumin in the presence of oxalic and hydrochloric acids. The method can be applied for the determination of B in methanol distillates obtained from B separation procedures. (auth)

9999 WIN-55

National Lead Co. Raw Materials Development Lab., Winchester, Mass.

A SPECTROPHOTOMETRIC INVESTIGATION OF VANADIUM(V) SPECIES IN ALKALINE SOLUTIONS. Leonard Newman, William J. LaFleur, Frederick J. Brousaides, and Arthur M. Ross. June 10, 1957. 41p. Contract AT(49-6)-924. $7.80(ph OTS); $3.30(mf OTS).

The interpretation of spectrophotometric data has demonstrated that both monohydrogen orthovanadate and pyrovanadate are formed during the first break in the titration of orthovanadate with acid. A constant of 0.097 ± 0.005 has been obtained at 25°C for the hydrolysis of orthovanadate to monohydrogen orthovanadate at an ionic strength of 3.0 for V concentrations of 2×10^{-4}M to 1×10^{-2}M, hydroxide concentrations of 0.01M to 3.0M and wavelengths of 260 to 360 mμ. A constant of 48 ± 5 has been obtained for the dimerization of monohydrogen orthovanadate to pyrovanadate for V concentrations of 0.01M to 0.1M and hydroxide concentrations of 0.0015M to 0.01M. (auth)

10000 AEC-tr-2940

ANALYSIS OF GAS MIXTURES BY DETERMINATION OF HEAT CONDUCTIVITY. V. G. Fastovskii (Fastovskiy) and A. Ye. Rovinskii (Rovinskiy). Translated from Zavodskaya Lab. 10, 1157-61(1949). 5p.

A device for the analysis of gas mixtures by determination of their heat conductivity is described. The apparatus is very convenient, permitting analysis in 2 to 3 minutes, and is suitable for continuous operation with automatic recording of results. Gas consumption for analysis does not exceed 100 to 200 ml. If so desired, all the gas may be collected in a gas holder, thus reducing losses to zero. During continuous analysis, the rate of passage of the gas through the apparatus is 40 to 50 ml/min. The analyzed gas may then be joined with the main gas flow. (auth)

10001

DETERMINATION OF MOLYBDENUM IN TITANIUM ALLOYS BY PRECIPITATION FROM HOMOGENEOUS SOLUTION USING THIOACETAMIDE. William N. McNerney and William F. Wagner (Univ. of Kentucky, Lexington). Anal. Chem. 29, 1177-8(1957) Aug.

Molybdenum in titanium alloys can be determined by precipitation of molybdenum sulfide with thioacetamide. The method obviates the use of a rapid stream of hydrogen sulfide and a long digestion period. A dense precipitate is formed which is easily filterable without the use of paper pulp. (auth)

10002

ABSORPTIOMETRIC METHOD FOR DETERMINATION OF CESIUM. William G. Krochta and M. G. Mellon (Purdue Univ., Lafayette, Ind.). Anal. Chem. 29, 1181-4(1957) Aug.

A new method is described for the indirect determination of Cs by precipitation with excess tungstosilicic acid, with subsequent development of a heteropoly blue color from the excess precipitant. The effects of several variables on the precipitation reaction and the color development were determined and optimum conditions were ascertained. Conformity to Beer's law was found for concentrations between 0.133 and 0.931 mg. of Cs per ml. The determination may be performed in the presence of limited amounts of K and Rb. (auth)

10003

DETERMINATION OF LOW CONCENTRATIONS OF RADIOACTIVE CESIUM IN WATER. Bernd Kahn, David K. Smith, and Conrad P. Straub (Oak Ridge National Lab., Tenn.). Anal. Chem. 29, 1210-13(1957) Aug.

Three methods for determining small amounts of radioactive Cs in water are presented. Radioactive Cs, with milligram quantities of CsCl carrier, is precipitated as cesium ammonium phosphomolybdate, coprecipitated with sodium potassium cobaltinitrite, or concentrated on a cation exchange resin from liter volumes of water, and then purified by established radiochemical procedures. Studies with radioactive tracers indicate satisfactory chemical yield, tracer recovery, and decontamination from long-lived fission products. After development, the methods were used to determine radioactive Cs in river water in concentrations between 10^{-4} and 10^{-8} microcurie per ml. (auth)

10004

THE REDUCTION OF Th^{4+} IONS IN CHLORIDE MELTS BY METALLIC THORIUM. M. V. Smirnov and L. E. Ivanovskiĭ (Sverdlovsk Acad. of Sciences). Zhur. Fiz. Khim. 31, 801-7(1957) Apr.

Studies of thorium reactions with chloride melts containing 6 to 11% by weight $ThCl_4$ showed that at 500 to 900°C the metal dissolves in the melts reducing Th^{4+} to Th^{2+}. The thorium potential and the potential of an indifferent molybdenum electrode were measured against a chlorine electrode. Calculations were made of the temperature dependence of constants in thermodynamic equations for the state of equilibrium potentials. (R.V.J.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

10005

THE CRYSTAL STRUCTURE OF $HCrO_2$. Robert M. Douglass (Los Alamos Scientific Lab., N. Mex.). Acta Cryst. 10, 423-7(1957) June.

A structure for $HCrO_2$ has been found in which one chromium(III) ions lies in 1(a) 0, 0, 0 and two oxygen ions in 2(c) x, x, x; $\bar{x}$, $\bar{x}$, $\bar{x}$ of space group $R\bar{3}m$. The single parameter x has been determined from powder data by trial-and-error to be 0.405 ± 0.003, with a residual factor R of 0.06 for resolved reflections not seriously affected by preferred orientation. The structure consists of distorted $(CrO_6)^{-9}$ octahedra, each sharing six of its edges with six surrounding coplanar octahedra to form continuous sheets in which the anions are close packed, lying parallel to the prominent {111} cleavage. This and certain other MX_2 structures containing sheets of linked octahedra differ from one another essentially only in the manner of superposition of successive sheets. In this structure the sheets are stacked so that oxygen ions of adjacent sheets are exactly superposed, hence the anions in the structure as a whole are only partly close packed. One hydrogen ion lies between each pair of superposed oxygen ions, this O–H–O distance being 2.55 ± 0.08 A, in accord with infra-red absorption data. Symmetry indicates symmetrical hydrogen bonds, and in this respect the $HCrO_2$ structure appears unique among known isoformular structures. (auth)

10006

DIAGRAM OF MOLYBDENUM RECRYSTALLIZATION. E. M. Savitskii, V. V. Baron, and K. N. Ivanova (Baikov Inst. of Metallurgy, Acad. of Sciences U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 113, 1070-2(1957) Apr. 11. (In Russian)

Investigations of molybdenum recrystallization showed that hot forged molybdenum after cold treatment with deformation above 20% and annealed at temperature up to 1400° retained the fine grain. The molybdenum annealed at higher temperatures acquired a large crystal structure. (R.V.J.)

10007

CRYSTALLINE FIELD SELECTION RULES: THE EFFECT OF VIBRATION-ELECTRONIC INTERACTION. Robert A. Satten (Univ. of California, Los Angeles). J. Chem. Phys. 27, 286-99(1957) July.

It is pointed out that the selection rules for stationary ions in crystalline electric fields are violated for many transitions in the neodymium bromate and ethylsulfate absorption spectra, making it impossible consistently to assign irreducible representations to crystalline levels. The appearance of spectral lines not obeying the usual crystalline field selection rules is assumed to be due to the interaction of the vibration of the rare earth ion or ion-water complex with its electronic motion about the nucleus. The theory of such an interaction is presented and selection rules derived for D_{3h}, C_{3v}, D_3, C_3, and C_{3h} local symmetries about the equilibrium position. It is found that the vibration interaction can account for the type of violations seen and with intensities that are probably comparable to some allowed pure electronic transitions. A satellite structure, which is a consequence of the vibration-electronic interaction, is predicted for all spectral lines except transitions between upper and lower $J = \frac{1}{2}$ or $J = 0$ levels. Such a structure may be manifested experimentally as a high-temperature "line width." Such satellites of pure electronic transitions should obey the same selection rules and have the same Zeeman effect as the "parent" pure electronic transition. The intensity of the individual satellite components of a line does not depend on the strength of the vibration-electronic interaction but only on the Boltzmann factors of their lower state and on the intensity of the parent line. (auth)

10008

ISOTOPE EFFECTS ON THERMODYNAMIC FUNCTIONS OF HINDERED ROTATORS. W. H. Stockmayer (Massachusetts Inst. of Tech., Cambridge). J. Chem. Phys. 27, 321-2(1957) July.

DEUTERIUM AND DEUTERIUM COMPOUNDS

10009

A DYNAMIC PROGRAMMING SOLUTION TO A PROBLEM IN HEAVY WATER PRODUCTION. Richard Bellman (RAND Corp., Santa Monica, Calif.). Nuclear Sci. and Eng. 2, 523-5(1957) July.

10010

A METHOD FOR INVESTIGATING THE ISOTOPIC EXCHANGE REACTION IN A LIQUID DEUTERIUM FLUORIDE MEDIUM. Ya. M. Varshavskii and M. G. Lozhkina (Karpov Moscow Physico-Chemical Inst.). Zhur. Fiz. Khim. 31, 911-14(1957) Apr. (In Russian)

A method for obtaining pure liquid hydrogen fluoride enriched with deuterium and a procedure for hydrogen isotopic exchange studies in this solvent are described. (tr-auth).

FLUORINE AND FLUORINE COMPOUNDS

10011

INFRARED SPECTRUM AND MOLECULAR CONSTANTS OF GASEOUS TRITIUM FLUORIDE. Llewellyn H. Jones and Maxwell Goldblatt (Los Alamos Scientific Lab., N. Mex.). J. Molecular Spectroscopy 1, 43-8(1957) July.

The vibration-rotation lines of $\nu_{1\leftarrow 0}$ and $\nu_{2\leftarrow 0}$ for tritium fluoride (g) have been observed with ≈ 1 cm^{-1} and ≈ 2.5 cm^{-1} resolution, respectively. Molecular constants were calculated from the observed frequencies. Within the accuracy of measurement the observed constants agree with those previously reported for hydrogen fluoride (g). The "least squares" values of the molecular constants in cm^{-1} are: $\nu_{1\leftarrow 0} = 2443.86$, $\nu_{2\leftarrow 0} = 4823.8$, $\omega_e = 2508.5$, $x_e\omega_e = 32.5$, $B_e = 7.69$, $\alpha_e = 0.176$, $D_e = 2.5 \times 10^{-4}$. The bond distance is 0.917 A, and the force constant is 9.65×10^5 dynes/cm. (auth)

10012

THE ACIDITY FUNCTION OF BORON FLUORIDE IN PHOSPHORIC ACID SOLUTIONS. M. I. Vinnik, R. N. Kruglov, and N. M. Chirikov (Inst. of Physical Chemistry, Acad. of Sciences U.S.S.R.). Zhur. Fiz. Khim. 31, 832-5 (1957) Apr. (In Russian)

The acidity functions of boron fluoride solutions in 98.5% phosphoric acid have been measured by the indicator method, using 2,4 dinitroaniline, 6-bromo-2,4 dinitroaniline, and anthraguinone as indicators. It was found that with the saturation of phosphoric acid with BF_3 the acidity of the medium increases. At saturation point of $BF_3/(H_3PO_4 + H_2O) = 1$, the acidity function assumes the value of −8.70. (tr-auth)

GRAPHITE

10013

ON THE COMPLETE X RAY DISPERSION STUDY OF GRAPHITE AND COLLOIDAL PREPARATIONS. L. A. Feigin and V. N. Rozhanskiĭ (Lomonosov Moscow State Univ.). Doklady Akad. Nauk. S.S.S.R. 113, 1102-5(1957) Apr. 11. (In Russian)

An attempt was made to find the particle distribution function according to the size in high-dispersion graphite systems. Studies were made of graphite preparations

with various size particles. It was observed that after 30 hr of crushing the generally inert graphite becomes highly dispersive and during unloading heats in the air up to ~700°. The analysis was made of various dispersion powders on the radiogram lines $11\bar{2}0$ and $11\bar{2}2$. Investigations of various index lines permitted also the evaluation of the powder crystalline form which appeared to be of disk shape with the height several times smaller than the diameter. (R.V.J.)

10014

PROPERTIES OF THE INTERSTITIAL COMPOUNDS OF GRAPHITE. IV. PROPERTIES OF N-TYPE COMPOUNDS. Marceline L. Dzurus and Gerhart R. Hennig (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 27, 275-81 (1957) July.

A method has been developed for introducing known quantities of donor impurities into graphite. Some electrical properties of such N-type doped graphite have been measured at various temperatures. Most of the results are in qualitative agreement with theory, and complement previously published results on P-type compounds. It appears that intercrystalline barriers do not influence the electrical property changes during doping, but that the impurities aggregate to some extent and produce channels which differ in properties from the bulk material. (auth)

10015

RADIATION-INDUCED HARDNESS CHANGES IN GRAPHITE. K. E. Horton and R. L. Carter (Atomics International, Division of North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 2, 513-15(1957) July.

Changes in Knoop Hardness of artificial graphite from the range 9 to 12 to the range 30 to 75 are found to accompany fast neutron irradiation at 30°C. (auth)

LABORATORIES AND EQUIPMENT

10016

TWO RESISTANCE-TYPE HOT-PRESSING FURNACES FOR LABORATORY USE. R. F. Walker and S. G. Bauer (National Bureau of Standards, Washington). Rev. Sci. Instr. 28, 563-8(1957) July.

MOLECULAR STRUCTURE

10017

NUCLEAR QUADRUPOLE INTERACTION IN BORON COMPOUNDS. T. P. Das (Cornell Univ., Ithaca, N. Y.). J. Chem. Phys. 27, 1-10(1957) July.

10018

ANALYSIS OF SPIN-SPIN INTERACTION IN THE NUCLEAR MAGNETIC RESONANCE SPECTRA OF SYMMETRICAL MOLECULES. E. Bright Wilson, Jr. (Harvard Univ., Cambridge, Mass.). J. Chem. Phys. 27, 60-8(1957) July.

Some techniques are given for utilizing molecular symmetry in setting up the equations for spin-spin coupling in molecules in the liquid state. Applications of group theory to factoring the secular equation, determining selection rules, etc. are similar to those developed for the problem of molecular vibrations. Sym-trifluorobenzene is used to illustrate the procedures. (auth)

10019

VARIATIONAL CALCULATION OF THE NUCLEAR MAGNETIC SHIELDING OF THE PROTON. Bruce R. McGarvey (Univ. of California, Berkeley). J. Chem. Phys. 27, 68-74 (1957) July.

A variational method employing the unperturbed ground-state wave function for the molecule is used to calculate the shielding of the proton in the hydrogen and hydrogen halide molecules. Surprisingly good results are obtained in view of the approximations employed in the calculation. The computations show that the shielding depends on the ionic character of the bond, the bond distance, and the number of electrons on the atom to which the hydrogen is bonded. (auth)

10020

HIGHER APPROXIMATIONS FOR THE TRANSPORT PROPERTIES OF BINARY GAS MIXTURES. I. GENERAL FORMULAS. Edward A. Mason (Univ. of Maryland, College Park). J. Chem. Phys. 27, 75-84(1957) July.

Higher approximations for the transport properties of binary gas mixtures are derived by the method of Chapman and Cowling, and by an extension of a method due to Kihara. Particular attention is paid to diffusion and thermal diffusion because of their importance in obtaining information on the forces between unlike molecules. The results can be used to test the convergence and accuracy of the theoretical formulas for various molecular models, and to supply higher correction terms if needed. (auth)

10021

NUCLEAR MAGNETIC RELAXATION IN POLYTETRAFLUOROETHYLENE AND POLYETHYLENE. C. W. Wilson, III and G. E. Pake (Washington Univ., St. Louis, Mo.). J. Chem. Phys. 27, 115-22(1957) July.

Nuclear magnetic resonance studies of the linear chain polymer polytetrafluoroethylene (Teflon) indicate the coexistence of two phases, each characterized by its own pair of relaxation times T_1 and T_2. Decomposition of the complex resonance lines and complex saturation curves into normal curves permits determination of the fraction of nuclei in each phase. It is suggested that the phases are the crystalline and amorphous regions of these polymers, and some additional evidence to support this suggestion is presented. The phase thought to be crystalline shows a marked line-narrowing at the first-order thermodynamic-transition point near 293°K. The less complete data presented for polyethylene suggest the analogous presence of two phases, and the line-shape analysis yields reasonable values for the degree of crystallinity. (auth)

10022

MICROWAVE SPECTRUM AND MOLECULAR STRUCTURE OF BROMINE TRIFLUORIDE. D. W. Magnuson (Union Carbide Nuclear Co., Oak Ridge, Tenn.). J. Chem. Phys. 27, 223-6(1957) July.

The moments of inertia and quadrupole coupling coefficients of both $Br^{79}F_3$ and $Br^{81}F_3$ were determined from a number of microwave transitions. From the moments of inertia the bromine trifluoride molecule was found to have a planar distorted–T structure with one short, 1.721 A, and two long, 1.810 A Br–F bonds. The FBrF' angle was found to be 86° 12.6'. (auth)

RADIATION CHEMISTRY

10023

NEW FACILITIES, EXTENSIVE STUDY LEAD WAY TO RADIATION PROCESSING OF PETROLEUM. Chem. Eng. Progr. 53, 118, 120, 122(1957) July.

A report is presented on the growing importance being given radiation processing techniques by petroleum refiners and progress in the application of nuclear radiation to chemical processing. (auth)

10024

HALOGEN ATOM REACTIONS INITIATED BY NUCLEAR PROCESSES IN HYDROCARBON SOLUTIONS. Sukumar Aditya and John E. Willard (Univ. of Wisconsin, Madison). J. Am. Chem. Soc. 79, 3367-71(1957) July 5.

The organic yields of I^{128} and Br^{80} activated as a result of the $I^{127}(n,\gamma)I^{128}$, $Br^{79}(n,\gamma)Br^{80}$ and $Br^{80m} \rightarrow Br^{80}$ processes are higher in dilute hydrocarbon solutions than in pure organic halides. They increase with increasing chain length of the hydrocarbon. For the (n,γ) activations in hydrocarbon solutions they decrease by about one-fifth in going from 0 to 100°C. These variations in yield are all rather insensitive to the addition of free halogen as scavenger and therefore involve "hot" processes. The results, correlated with those of other investigations, suggest that a number of previously unexplained facts about reactions of hydrogenous material with I^{128}, Br^{80}, and Cl^{38} activated by the (n,γ) process may be explained by ionic reactions. The organic yields from the Br^{80m} isomeric transition in liquid hydrocarbons depend on the source molecule containing the Br^{80m} to an extent which is consistent with earlier observations of failure of the transition to rupture C-Br bonds in liquid bromine as the solvent. (auth)

10025

ADSORPTION OF RADIATION BY A CYLINDRICAL SAMPLE OF A STRONG ABSORBER. William H. Clingman, Jr. (American Oil Co., Texas City). J. Chem. Phys. 27, 322-3(1957) July.

10026

RADIOLYSIS OF SOLID NITRATES. C. J. Hochanadel and T. W. Davis (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 27, 333-4(1957) July.

10027

RADIATION-INDUCED DECOMPOSITION OF THORIUM NITRATE SOLUTIONS. J. W. Boyle and H. A. Mahlman (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, 492-500(1957) July.

Concentrated thorium nitrate solution has been proposed as a blanket material in power-breeder reactors. The radiation stability, especially of the nitrate group, is therefore of considerable importance. The radiation-induced decomposition of thorium nitrate solutions was studied as a function of concentration, type of radiation (fission recoils, pile radiations, gamma rays), temperature, and total energy absorbed. The principal products were H_2 and O_2 from decomposition of the nitrate. Hydrogen yield decreased with increasing thorium nitrate concentration, a behavior similar to that for uranium solutions. Nitrogen yield was independent of temperature, but increased with increasing nitrate concentration and with increasing linear energy transfer along the paths of the ionizing particles. The 100-ev yield of N_2 in 2.73 molal solution was 0.06 for fission particle decomposition, 0.006 for pile radiation (mixed fast neutrons and γ rays) and 0.001 for γ radiation alone. The oxide of nitrogen produced with the largest yield was N_2O and amounted to about ten per cent of the N_2 yield. In-pile autoclave measurements indicated little radiation-induced back reaction of the nitrogen. (auth)

RADIATION EFFECTS

10028

MACHINES GIVE CHEAPER RADIATION. C. H. Stockman and R. G. Bauman (B. F. Goodrich Co., Beckersville, Ohio). Chem. Eng. News 35, No. 31, 16-21(1957) Aug. 5.

Proposed commercial applications of γ radiation in the production of benzene hexachloride and nitric acid; in the sterilization of food, drugs, antibiotics, hormones, and tissue transplant materials; as a chemical polymerization catalyst; and in the vulcanization of rubber and other elastomers are discussed. Efficiency and costs of irradiation machines are compared with γ radiation from isotopes. Present prices and possible future prices are considered. It is concluded that isotopes will be too costly for wide use in radiation processing until spent nuclear fuel sources are available, and that machine radiation is the cheapest source available at present. (C.H.)

10029

DETERMINATION OF MAGNETIC CENTERS IN IRRADIATED BIOLOGICAL MEDIA AND THEIR IMPORTANCE IN RADIOBIOLOGY. Karl G. Zimmer, Lars Ehrenberg, and Anders Ehrenberg. Strahlentherapie 103, 3-15(1957). (In German)

The production of magnetic centers in amino acid glycine and in barley embryos following exposure to low doses of x radiation was demonstrated. Applications of the findings to an analysis of the mechanisms of biologic action of ionizing radiations, and the possibility of ionization of organic molecules leading directly to long lived radicals, are discussed. It is suggested that the slow decay of magnetic centers, their dependence on the presence of oxygen, and some properties of the paramagnetic resonance spectra of irradiated proteins may explain such phenomena as after-effects of irradiation, the influence of oxygen pressure, and the action of radioprotective substances. (C.H.)

Refer also to abstract 9945.

RARE EARTHS AND RARE-EARTH COMPOUNDS

10030

SEPARATION OF CERTAIN RARE-EARTH ELEMENTS BY A DRYING METHOD. APPLICATION TO YTTERBIUM. Jean-Claude Achard. Compt. rend. 244, 3059-62(1957) June 17. (In French)

The action of carbon, at high temperature and under pressure, on a mixture of rare earth oxides permits separation by distillation of Sm, Eu, and Yb. It is shown that Yb can be completely separated and recovered in a pure state, either metal or lower oxide. (tr-auth)

10031

COMPLEX COMPOUNDS OF LANTHANUM, CERIUM, PRASEODYMIUM, AND NEODYMIUM WITH THIOUREA. N. N. Sakharova (Chernyskevskiĭ Saratov State Univ.). Doklady Akad. Nauk S.S.S.R. 113, 1073-5(1957) Apr. 11. (In Russian)

Anhydrous rare-earth acetates and thiourea with melting points 180 to 182° were used to prepare the complex rare-earth elements. The molecular ratio was taken as 1:2, anhydrous acetate metal to thiourea. The prepared compounds were stable in water and easily recrystallized without changing their chemical composition. For La complex the melting point was at 258 to 260°, for Ce at 225 to 226°, for Pr at 292 to 293°, and for Nd at 297 to 298°. At the above temperatures the complex compounds melted with disintegration. Analysis of rare-earth element contents in the anhydrous complexes is presented. (R.V.J.)

10032

CAESIUM IN STONY METEORITES. B. M. Gordon and L. Friedman (Brookhaven National Lab., Upton, N. Y.) and G. Edwards (Shell Development Co., Houston, Texas). Geochim. et Cosmochim. Acta 12, 170-1(1957).

SEPARATION PROCEDURES

10033 AERE-C/R-289

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

REMOVAL OF α ACTIVITY FROM EFFLUENT. SOME EXPERIMENTS ON THE USE OF TANNIC ACID AND

LIME. A. A. Smales and L. Airey. Dec. 1948. Decl. May 9, 1957. 9p.

Experiments are described showing that a simple treatment of tap water with tannic acid followed by lime water to pH 7.5 will remove 98 to 100% of the α activity due to added U, Pu, or Po whereas in the absence of tannic acid very little U is removed. The quantity of tannic acid needed is related to the amount of U to be removed, a 10:1 tannic acid: U ratio being satisfactory. The precipitate settles and filters readily, and the treatment is suggested as one possibly applicable to the Harwell effluent. A similar treatment, followed by a delay period after filtration of two weeks, will remove >96% of the α activity due to Th and its daughters. The treatment is not satisfactory for Ra and daughters (approximately 50% efficiency for α's) while for fission products it is only partially successful (85% efficient for β's). (auth)

10034 AERE-M/M-67

Gt. Brit. Atomic Energy Research Establishment, Harwell, England.

AN OXIDE–CHLORIDE CONVERSION PROCESS FOR THE EXTRACTION OF CERTAIN METALS. A. R. Gibson. Feb. 5, 1954. Decl. Apr. 2, 1957. 9p.

A method is described whereby some metallic oxides may be converted to chlorides in solution in alkaline earth chlorides; a fluid melt substantially oxygen free is generated. From this, metal may be precipitated and recovered. The possible chemical actions involved are also examined, and a tentative theory put forward for the mechanism of the chlorination based on experiments with UO_2 and ThO_2. (auth)

10035 LA-2054UNM

New Mexico. Univ., Albuquerque.

ION-EXCHANGE RESINS. A Bibliography of Unclassified References. Milton Kahn, Katheryn Lawson, and Kent J. Jones. July 1956. 180p. For Los Alamos Scientific Lab. Contract W-7405-Eng-36. $1.00(OTS).

This bibliography contains 2088 references to unclassified work on ion-exchange resins. Information is included on the preparation and properties of resins, the preparation of inorganic and organic compounds, the separation of elements and biological materials, the determination of physicochemical properties of ions in solution, the purification of water, and on applications to analytical chemistry, pharmacy, medicine, and various industries. The references were obtained from Chemical Abstracts, 1947 to 1954, inclusive. (auth)

10036 ORNL-2346

Oak Ridge National Lab., Tenn.

PROGRESS REPORT ON RAW MATERIALS FOR APRIL 1957. K. B. Brown, C. F. Coleman, D. J. Crouse, and A. D. Ryon. July 22, 1957. 27p. Contract W-7405-eng-26. $0.25(OTS).

Systematic Studies. The enhanced U extraction coefficients obtained with synergistic combinations of di(2-ethylhexyl)phosphoric acid (D2EHPA) and trialkylphosphate, dialkyl alkylphosphonate, or trialkylphosphine oxide reach maxima at characteristic concentrations of the neutral components which appear to be essentially independent of the D2EHPA concentration. The coefficients vary with D2EHPA concentration and with pH and sulfate concentration of the aqueous solution in the same way as in extractions with D2EHPA alone. In brief examination of the extractions of some metals other than U by amines, alkylphosphoric acids, and phosphine oxides, strong extraction of Th was found with D2EHPA, and potential separations were indicated between rare earths, Hf–Zr and Co–Ni. Process Development Studies. Aqueous slurries of several different commercial magnesias stripped U effectively from tri-n-octylamine in kerosene plus 3% alcohol. Stripping of Amine 9D-178 in kerosene was more rapid at 38°C than 28°C although stripping results were favorable at both temperatures. The presence of Mo in the amine extracts decreased the rate of U stripping. Molybdenum was stripped more slowly than U. Engineering Studies. Studies were made of the mixing requirements for stripping U from the Dapex type solvent with Na_2CO_3. Stage efficiency was greater than 90% with a residence time of 0.38 min and a power input of 0.01 hp/gal. (For preceding period see ORNL-2306.) (auth)

10037 RMO-2045(Del.)

International Minerals and Chemical Corp., Chicago.

ORE DRESSING OF LEACHED ZONE. Harold W. Long, Jr., J. B. Adams, and Roger Bart. Feb. 28, 1955. Changed from OFFICIAL USE ONLY with deletions Feb. 5, 1957. 34p. Contract AT(49-1)-545. (IMCC-2216(Del.)).

Preliminary investigations of leached-zone prospect cores showed that an average of 75% of the U_3O_8, 88% of the Al_2O_3, and 67% of the P_2O_5 is found in the plus 14 and minus 200 mesh fractions. These fractions represent approximately 35%, on a dry basis, of the total leached zone mined. Methods were developed to separate and concentrate these fractions from raw leached zone ore by wet ore dressing procedures. This concentrate would be used as a process feed in plant operations. (auth)

10038

SEPARATION OF URANIUM FROM THORIUM, BISMUTH, AND ORES WITH TRIBUTYL PHOSPHATE. SPECTROPHOTOMETRIC DETERMINATION WITH 8-QUINOLINOL. A. R. Eberle and M. W. Lerner (U. S. Atomic Energy Commission, New Brunswick, N. J.). Anal. Chem. 29, 1134-9(1957) Aug.

Uranium in Th, Bi, and a variety of ores can be separated by extraction with tributyl phosphate in such purity as to permit its determination with 8-quinolinol. Uranium is separated from Th by extraction from a HCl solution, and from Bi and other elements from a HNO_3 solution. Optimum conditions for the extraction of U from HNO_3 solution and the subsequent color development with 8-quinolinol are presented. Results are reported on the recovery of U from synthetic solutions containing many diverse ions. Thorium, Bi, and low-grade ores were analyzed. (auth)

10039

MECHANICAL ENERGY IMPROVES DIFFUSIONAL SEPARATIONS. Herbert F. Wiegandt (Cornell Univ., Ithaca, N. Y.). Chem. Eng. 64, No. 8, 273-9(1957) Aug.

Applying mechanical energy to aid mass transfer improves many diffusional separations. Among the most likely ones are ion exchange, adsorption, molecular distillation, gas absorption, and extraction. (auth)

SORPTION PHENOMENA

10040 AERE-C/R-1055

Gt. Brit. Atomic Energy Research Establishment, Harwell, England.

THE THEORY OF PHYSICAL ADSORPTION. PART I. THERMODYNAMICS. J. K. Perring. Nov. 3, 1952. 20p.

A form of thermodynamics suitable for application to problems in adsorption is developed, and contrasted with normal solution thermodynamics. Methods are given for the calculation of the integral and partial molar thermodynamic functions from experimental isotherm and calorimetric measurements, and the advantages in using these functions are pointed out. The views of Everett on this question are criticized. (auth)

SPECTROSCOPY

10041

VIBRATION SPECTRUM OF GRAPHITE AND BORON NITRIDE. II. THE THREE-DIMENSIONAL SPECTRUM. Gordon F. Newell (Brown Univ., Providence, R. I.). J. Chem. Phys. 27, 240-50(1957) July.

A detailed analysis of the spectrum of graphite and boron nitride with a description of the two-dimensional spectrum neglecting the interaction between layers is completed here with the inclusion of the coupling between layers. Of particular interest is the low-frequency end of the spectrum which is distorted by the coupling in such a way as to cause a significant change in the thermodynamic behavior of the system at sufficiently low temperatures. Although most of the qualitative features of the spectrum have been described elsewhere, it is shown here that it is actually possible to find find analytic approximations to the Born-von Kármán spectrum within well-defined limits of accuracy. The lack of experimental measurements of the elastic constants and other relevant data, however, makes any quantitative calculation of specific heat very difficult although it is apparent that the model is capable of explaining qualitatively the peculiar properties of these highly anisotropic crystals. (auth)

SYNTHESES

10042 NP-6344

Wyandotte Chemicals Corp., Wyandotte, Mich.
SYNTHESIS AND EVALUATION OF HIGH TEMPERATURE STABLE AND NUCLEAR RADIATION STABLE METAL–CYCLOPENTADIENYL FLUIDS. Quarterly Progress Report No. 1 Covering Period March 15, 1957 to May 31, 1957. June 20, 1957. 13p. Project No. 7(1-7331). Contract AF33(616)-5052.

Research was begun on the synthesis of siloxane-substituted and ether-substituted ferrocenes to be considered for application as high temperature hydraulic fluids and aircraft lubricants. After a brief literature survey of methods for the synthesis of simple mono-substituted cyclopentadienes (precursors of ferrocenes), approaches to the synthesis of the required silicon-substituted and alkoxy-substituted cyclopentadienes were enumerated and experimental work begun. Two attempts to prepare ethoxycyclopentadiene from dibromocyclopentene with sodium ethoxide were unsuccessful. Substitution of sodium methoxide for sodium ethoxide in this reaction led to a low yield of an unidentified high boiling liquid. Dehydrobromination of dibromocyclopentene was accomplished with γ-collidine but tars were formed instead of the desired bromocyclopentadiene. In an attempt to prepare cyclopentadienyldimethylethoxysilane, dimethyldiethoxysilane was treated with cyclopentadienylmagnesium bromide in toluene at 110 to 120°C. A slow reaction took place, but distillation of the reaction mixture filtrate gave very little material boiling above 115°C. (auth)

10043 UCLA-395

California. Univ., Los Angeles. Atomic Energy Project.
A BIBLIOGRAPHY OF SYNTHESES WITH CARBON ISOTOPES, 1953-54. Judd C. Nevenzel, David R. Howton, Richard F. Riley, and Gunther Steinberg, comps. July 25, 1957. 172p. Contract AT(04-1)-GEN-12. $1.00(OTS).

References to the preparation of carbon-isotope-labeled compounds have been collected from the literature for 1953 and 1954, together with earlier material not included in UCLA-316. Pertinent information has been indexed according to formula and to author. (auth)

10044

THE SYNTHESIS OF CERTAIN ETHYLENEDIAMINE-PLATINUM(II) AND (IV) BROMIDES AND IODIDES. George W. Watt and Robert E. McCarley (Univ. of Texas, Austin). J. Am. Chem. Soc. 79, 3315-17(1957) July 5.

Methods for the synthesis of ethylenediamine coördination compounds of certain halides of Pt^{2+} and Pt^{4+} in high yield and high purity are described. It is shown that $[Pt(en)Br_2]$ and its isomer $[Pt(en)_2]PtBr_4$ may be separated quantitatively owing to the solubility of the former in liquid ammonia at −33.5°C. (auth)

10045

CHEMISTRY OF RHENIUM AND TECHNETIUM. I. SYNTHESIS OF $ReCl_5$, $TcCl_4$, AND RELATED COMPOUNDS. Kerro Knox, S. Young Tyree, Jr., Ram Dularay Srivastava, Vello Norman, Joseph Y. Bassett, Jr., and J. H. Holloway (Univ. of North Carolina, Chapel Hill). J. Am. Chem. Soc. 79, 3358-61(1957) July 5.

A general method for the synthesis of anhydrous metal chlorides has been developed. It is a modification of the method of Michael and Murphy in which the metal oxide and carbon tetrachloride are heated to 400° in a sealed glass tube. The glass tube is contained in a metal bomb with carbon tetrachloride or water in it to equalize the pressure. Pure preparations of $ReCl_5$, $TcCl_4$, $MoCl_5$, WCl_6, and $TaCl_5$ have been made. Preliminary results also indicate that Fe, Zr, Be, and V oxides are completely converted to chlorides; that Zn, Al, La, Th, and Nb oxides are partially converted; and that Co and Ni oxides are not converted. The highest chloride formed by the metal is found in all known cases. Technetium yields a blood-red powder identified by analysis as the tetrachloride. Thus, under ordinary conditions, the highest chloride of Tc is different from that of Re, which forms a pentachloride. (auth)

Refer also to abstract 10157.

TRACER APPLICATIONS

10046

FRACTIONATION OF OXYGEN ISOTOPES IN THE FORMATION OF OXIDE FILMS ON COPPER. John B. Brown, Malcolm Dole, and G. A. Lane (Northwestern Univ., Evanston, Ill.). J. Chem. Phys. 27, 251-8(1957) July.

URANIUM AND URANIUM COMPOUNDS

10047 AERE-T/M-134

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
CALCULATIONS ON THE RATE OF SWELLING OF GAS BUBBLES IN URANIUM. A. J. E. Foreman. Mar. 1956. Decl. May 9, 1957. 18p.

The approximate calculation made by Wyatt (M/R. 1750) of the rate of swelling of gas-filled cavities ("bubbles") in irradiated U is repeated, using a more detailed theoretical treatment of the quasiviscous creep flow of the metal in the neighborhood of each expanding cavity. The rate of swelling of irradiated uranium is found on the basis of the gas bubble model for two cases of interest: (i) steady irradiation of uranium at a constant temperature and (ii) the annealing of uranium previously irradiated at a lower temperature at which little swelling occurred. These calculations, which are supplementary to those described by Wyatt, show that the more precise treatment of the plastic creep flow problem leads to numerically different results. A comparison with some preliminary measurements of the swelling of irradiated uranium during annealing, however,

shows that the gas bubble model still fails to predict the correct order of magnitude of the swelling below a temperature of about 700°C. (auth)

10048 ANL-5677
Argonne National Lab., Lemont, Ill.
IRRADIATION OF CAST URANIUM–PLUTONIUM BASE ALLOYS. Final Report—Metallurgy Program 6.5.4. K. F. Smith and L. R. Kelman. May 1957. 16p. Contract W-31-109-Eng-38. $0.20(OTS).

A summary of changes resulting from irradiation of U–Pu alloys is given. The poor metallurgical properties can be attributed to the presence of small amounts of the brittle zeta phase in alpha U. Additions of Mo to the U suppresses the zeta phase and stabilizes the γ phase, thereby improving the metallurgical properties of the alloy. Fabrication of the specimens for irradiation is included. (W.L.H.)

10049 TID-3084
Technical Information Service Extension, AEC.
FEED MATERIALS: A BIBLIOGRAPHY OF UNCLASSIFIED REPORT LITERATURE. Gifford A. Young, comp. July 1957. 117p. $0.60(OTS).

"Feed materials" refers to U metal, fabricated into fuel elements but not clad, and UF_6, both of normal isotopic content, suitable for introduction into Pu-production reactors or gaseous diffusion cascades. The term may also apply to processes for producing such materials from ore concentrates or high-grade ores and to intermediates in these processes. Declassified feed material reports and unclassified reports on properties of materials, apparatus, analytical control, scrap recovery, etc., used in feed material processes are annotated. Author, Subject, and Report Number Indexes are included. 770 references. (auth)

10050
KINETIC STUDY OF THE OXIDATION OF URANIUM DIOXIDE. S. Aronson, R. B. Roof, Jr., and J. Belle (Westinghouse Electric Corp., Pittsburgh). J. Chem. Phys. 27, 137-44(1957) July.

Oxidation of UO_2 to U_3O_8 in dry air and oxygen at temperatures of 160 to 350°C proceeds by a two-step reaction. In the first step the tetragonal oxide of composition $UO_{2.34 \pm 0.03}$ is formed. In the second step this tetragonal phase is converted to orthorhombic U_3O_8. The rate controlling process in the first stage is the diffusion of oxygen through the uranium dioxide lattice. The value found for the diffusion coefficient D is $D = 5.5 \times 10^{-3} \exp[-(26{,}300 \pm 1500)/RT]$, where the activation energy is 26.3 ± 1.5 kcal/mole. The second stage of the reaction proceeds by a process of nucleation and growth. (auth)

10051
REFINING OF URANIUM. Bernhard Blumenthal (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, 407-26(1957) July.

Several of the contaminants of uranium can be removed or controlled by vacuum melting and liquation. The lower limits of carbon content which can be attained by liquation in urania crucibles are 225 to 250 ppm at 1195°C, 190 to 225 ppm at 1150°C, and 170 ppm at 1138°C. In magnesia crucibles the reaction $3\ MgO + UC \rightarrow UO_2 + CO + 3\ Mg$ proceeds to the right in a high vacuum resulting in incomplete carbon removal. Oxygen and nitrogen are rapidly removed by liquation, and contents of less than 10 ppm are readily obtained. Iron and silicon are not removed by a simple melting and liquation process. Various crucible materials were investigated, and the effect of addition agents such as nitrogen, tantalum, titanium, and zirconium was studied. Under optimum vacuum melting conditions a metal is produced that will contain no more than 130 to 300 ppm total impurities. (auth)

10052
HEAT OF ADSORPTION OF OXYGEN ON URANIUM DIOXIDE AT -183°C. I. F. Ferguson and J. D. M. McConnell (Atomic Energy Research Establishment, Harwell, Didcot, Berkshire). Proc. Roy. Soc. (London) A241, 67-79(1957) July 23.

A number of specimens of UO_2 have been prepared and studied in a nonadiabatic nonisothermal calorimeter at −183°C. Uptake of O_2 by the oxide is rapid. Incremental addition of O_2 has yielded differential heats of adsorption which decrease on all specimens as the surface becomes covered. The initial heat of adsorption is 55 ± 2 kcal/mole. The rate of evolution of heat becomes increasingly slow for successive increments of O_2 adsorbed. This slow process takes place after the disappearance of all the O_2 from the gas phase and must therefore be a reaction in or on the oxide. It is discussed in terms of a slow change to the chemisorbed state of O_2 molecules rapidly adsorbed initially in the physical state. (auth)

10053
URANYL PROTOPORPHYRIN: A NEW URANIUM COMPLEX. Robert E. Bases (New York Univ. Coll. of Medicine, New York). Science 126, 164-5(1957) July 26.

ENGINEERING

HEAT TRANSFER AND FLUID FLOW

10054 AERE-E/R-1095
Gt. Brit. Atomic Energy Research Establishment, Harwell, England.
THE PACKING AND FLOW OF SPHERES. W. H. Denton. Jan. 1953. 22p.

Amended version of AERE-E/R-254.

Experimental measurements of the reproducibility of the packing density of a stationary bed of randomly packed spheres with fluid flow through the bed are given. The packing density varies in a normally statistical manner about a most probable value which does not depend on the method of charging. (T.R.H.)

10055 APEX-313
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
METHOD FOR SOLUTION OF TURBULENT FLOW IN A HEATED ANNULUS ADAPTABLE TO DIGITAL COMPUTATION. R. N. Noyes. Mar. 2, 1956. 21p. (DC-56-3-97). $4.80(ph OTS); $2.70(mf OTS).

The details of a method for determining the temperature distribution at any axial cross section in an annulus through which an incompressible fluid is flowing which receives heat from the walls of the annulus are presented. The heat release from either wall may be a constant or any prescribed function of the axial distance through the annulus. The method is of such form as to permit ready solution by digital computing equipment. (auth)

10056 CF-55-11-180
Oak Ridge National Lab., Tenn.
PRESSURE DROP OF HEAT EXCHANGER TUBE SPACERS. M. H. Cooper. Nov. 28, 1955. 34p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

Compact, high performance, shell-and-tube heat exchangers require a bundle of closely packed, small diameter tubes. The problem of separating the tubes in the bundle can be solved by using flattened wire spacers. Various arrangements of the wire spacers have been tested in a model exchanger to determine the optimum spacer design from the pressure drop standpoint. Both tube fric-

tion factors and spacer friction factors, which may be used in the design of similar heat exchangers, were calculated from the experimental data. (auth)

10057 HW-47681
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PRESSURE DROP AND CRITICAL FLOW FOR STEAM–WATER MIXTURES. J. C. Firey and R. W. Moulton. Jan. 5, 1957 25p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

When a steam–water mixture flows through a pipe, the liquid flows slower than the vapor since the denser liquid is less accelerated by the pressure gradient. This type of flow is termed slip flow. A general solution of the mathematical relations for slip flow appears difficult to accomplish and an improvement or extension of the empirical pressure drop analysis, developed by Martinelli, is proposed. When the flow in a passage no longer increases with a decrease of back pressure critical flow exists. This effect can be attributed to the inability of any wave of pressure decrease to propagate upstream when flow velocity equals acoustic velocity. At the very high rates of expansion of critical flow, thermodynamic equilibrium is not maintained in steam-water mixtures. The resulting metastable expansion greatly increases the rate of flow over the equilibrium flow. Various degrees of metastability may occur and it does not appear always possible to reliably predict the extent of metastability. (auth)

10058 IGRL-IB/CA-23
Gt. Brit. Capenhurst Works. Capenhurst, Ches., England.
HEAT TRANSFER IN STATIC GRANULAR BEDS. Information Bibliography. E. McCoy and A. J. Townend. May 1957. 6p.

10059 KAPL-M-RES-37
Knolls Atomic Power Lab., Schenectady, N. Y.
FLOW REDISTRIBUTION IN A MATRIX DUE TO BOILING. J. Perry Fraser. Mar. 29, 1957. 18p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A method is presented for estimating steady-state flow and temperature distributions in a nuclear reactor fuel matrix with nonuniform heat generation and boiling. The matrix considered is composed of cylindrical fuel elements offering negligible transverse flow resistance. The flow redistribution treated is caused by the pressure drop increase attending boiling. It is shown that the flow redistribution due to a transverse variation in axial flow resistance within a matrix may be greater than that due to a change in flow resistance between parallel matrix channels. (auth)

10060 NACA-RM-52D03
Purdue Univ., Lafayette, Ind.
DESIGN OF APPARATUS FOR DETERMINING HEAT TRANSFER AND FRICTIONAL PRESSURE DROP OF NITRIC ACID FLOWING THROUGH A HEATED TUBE. Bruce A. Reese and Robert W. Graham. June 16, 1952. 61p.

A design basis is presented for test apparatus to measure heat-transfer and pressure-drop characteristics of white fuming nitric acid under conditions simulating those occurring in a regeneratively cooled rocket engine. The apparatus is designed so that heat-transfer and fluid-friction data can be obtained over the following ranges: inlet pressure to test section, atmospheric to 400 psia; mean fluid temperature at entrance to heated test section, −30 to 300°F; heat input to test section, 0.5 to 1.5 Btu per second per square inch; and Reynolds number, 60,000 to 200,000. (auth)

10061 WAPD-TH-300
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
ESTIMATION OF BOILING AND NON-BOILING PRESSURE DROP IN RECTANGULAR CHANNELS AT 2000 PSIA. N. C. Sher. [Mar. 29, 1957]. 68p. $10.80(ph OTS); $3.90(mf OTS).

10062 WAPD-TH-304
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].
ZERO-NET FLOW BURNOUT TESTS FOR WATER AT 2000 PSIA IN A VERTICAL 0.101 in. × 1 in. × 6 in. LONG RECTANGULAR CHANNEL. M. Troy. [Mar. 13, 1957]. 9p. $1.80(ph OTS); $1.80(mf OTS).

10063 WAPD-TH-308
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
BURNOUT DATA FOR 0.186 INCH INSIDE DIAMETER BY 12 INCHES LONG ROUND NICKEL TUBE. R. A. DeBortoli and R. Masnovi. Apr. 2, 1957. 14p. $3.30 (ph OTS); $2.40(mf OTS).

Burnout data for a 0.186 in. inside diameter × 0.227 in. outside diameter × 12 in. long Ni tube (L/D = 64.5) installed in a vertical position were obtained with water at 2000 psia. The mass velocities were varied from 0.20×10^6 to 4.20×10^6 lb/hr-ft^2, at inlet temperatures of 400, 500, 550, and 600°F. For the range of variables investigated, most of the measured values of burnout fluxes are from 0 to 50% higher than the values predicted by the equations of WAPD-SFR-Rs-444. Similar tests run on rectangular channels with the same L/D indicate that burnout in rectangular channels is about 5 to 20% higher than burnout in round tubes. (auth)

10064
ON THE PROPAGATION OF STRONG SPHERICAL BLAST WAVE IN HEAT CONDUCTING GAS. V. P. Korobeinikov (Steklov Math. Inst. Acad. of Sciences U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 113, 1006-9(1957) Apr. 11. (In Russian)

Analysis was made of the automodel problem for spherical shock wave propagation following point blast in absolute gas with heat conduction. (R.V.J.)

MATERIALS TESTING

10065 APEX-315
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
DESIGN CHARTS FOR ANALYSIS OF CIRCULAR PLATES WITH CENTRAL HOLES. (Structural Memo No. 10). Mileston Report II. H. A. Eagle. Apr. 15, 1957. 43p. (XDC-57-4-97). $7.80(ph OTS); $3.30(mf OTS).

The results of the stress analysis of circular plates, with central hole, supported at both inner and outer edges and loaded by a uniform pressure are described. The four cases of ideal edge fixity investigated are: both edges simply supported, clamped inner edge and simply supported outer edge, simply supported inner edge and clamped outer edge, and both edges clamped. The solution for various ratios of hole to plate diameter have been obtained by the method of superposition using IBM digital computers and the results are presented in the form of nondimensional design charts. The results of the analysis are limited by the usual restrictions of the thin plate, small deflection theory. (auth)

PUMPS

10066
CANNED MOTOR-PUMPS. Leo Walter. Atomics 8, 268-70 (1957) July.

The production of canned-motor liquid metal pumps by Westinghouse is described. (T.R.H.)

10067

A NEW TYPE OF IONIZATION-PUMP. George Comsa and Geavit Musa (Academy of the Rumanian People's Republic, Bucharest). J. Sci. Instr. 34, 291-2(1957) July.

An ionization pump is described which, it is claimed, is easier to build and outgas than the Bayard-Alpert gage. A tungsten filament, a tungsten grid, and the glass enclosure are the three electrodes. If all the ions captured by the glass wall are absorbed, pumping speeds of 0.2 to 0.4 l/sec are attained. (T.R.H.)

10068

ELECTROMAGNETIC PUMPS FOR REACTORS. W. B. Woollen (Atomic Energy Research Establishment, Harwell). Nuclear Power 2, 267-76(1957) July.

10069

MECHANICAL PUMPS AND CIRCULATORS. F. L. Speed (Atomic Energy Research Establishment, Harwell). Nuclear Power 2, 277-84(1957) July.

Various types of mechanical pumps used for handling nuclear reactor coolants and liquid fuels are reviewed. A brief reference to gas circulators is included because of their importance in this UK power program. (auth)

10070

PUMP BUYERS' GUIDE. Nuclear Power 2, 285-9(1957) July.

A survey in tabular form of the products of the British pump industry is presented. (J.E.D.)

RADIOGRAPHY

10071 WAPD-NCE-3608

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh]. A MODIFIED PROCEDURE FOR RADIOGRAPHING PWR CORE I FUEL ROD END CLOSURE WELDS AND THE ESTABLISHMENT OF VISUAL X-RAY ACCEPTANCE STANDARDS. A. E. Oaks. Feb. 28, 1957. 13p. $3.30 (ph OTS); $2.40(mf OTS).

Modifications were introduced into the x-ray procedure for radiographing PWR Core I fuel rod end closure welds which permitted more accurate inspection of the finished films. To further facilitate inspection visual standards illustrating defects were established. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

10072 CRHP-692

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

ELECTROLYTIC DECONTAMINATION OF STAINLESS STEEL. P. J. Barry. Mar. 1957. 18p. (AECL-443).

It has been found that the rate and extent of decontamination increases with the current density applied. The efficiency of current utilization however, reaches a maximum at 30 ma/sq. in. which suggests that a vigorous evolution of gases is not necessarily advantageous. Agitation is desirable. In a study of a few simple electrolytes it has been found that $Na_2C_2O_4$ or $H_2C_2O_4$ in 1% concentration are effective. The addition of 0.5% wetting agent (Nacconal or Hydraclene) improves the performance of the bath. (auth)

CERAMICS AND REFRACTORIES

10073 NYO-8527

Penn-Texas Corp., New York.

DEVELOPMENT OF CERMETS, 1950–1956. (A Bibliography). Helen C. Friedemann, comp. June 7, 1957. 31p. Project SLIP CASTING. Contract AT(30-1)-1991. $6.30 (ph OTS); $3.00(mf OTS).

The bibliography has been compiled in order to get acquainted with the more recent developments of metal–nonmetal combinations, known as cermets. It is believed, and there are indications, that mixtures of metallic and nonmetallic powder particles are especially suitable for the slip casting process. The pressureless forming, which is the aim of slip casting, will avoid stresses in the compact which usually result with the conventional compacting under pressure, which stresses are frequently detrimental to sintering of metal–nonmetal powder compacts. This bibliography will be valuable also to any research worker involved in cermet development, not only for nuclear reactor applications, but also for high temperature purposes. (auth)

10074

SOLID SOLUTIONS OF BARIUM METANIOBATE AND METATANTALATE IN BARIUM TITANATE POSSESSING SIGNETOELECTRIC PROPERTIES. G. A. Smolenskiĭ, V. A. Isupov, and A. I. Agranovskaya (Inst. of Semiconductors, Acad. of Sciences U.S.S.S.R.). Doklady Akad. Nauk. S.S.S.R. 113, 1053-6(1957) Apr. 11. (In Russian)

Solid solution substitutions were studied using the prepared polycrystals $BaTiO_3-Ba_{0.5}NbO_3$ and $BaTiO_3-Ba_{0.5}TaO_3$ with $Ba_{0.5}NbO_3$ and $Ba_{0.5}TaO_3$ content up to 10 mole %. The temperature dependence of dielectric penetration ϵ and the angular tangent tg δ of the dielectric losses in the $BaTiO_3-Ba_{0.5}NbO_3$ and $BaTiO_3-Ba_{0.5}TaO_3$ were investigated. The introduction of barium metaniobate into barium titanate sharply changed the temperature dependence of ϵ and tg δ. A phase diagram of transitions from cubic phase to tetragonal and from tetragonal to orthorombic was constructed for the $BaTiO_3-Ba_{0.5}NbO$ and $BaTiO_3-Ba_{0.5}TaO_3$ systems based on the dielectric penetration dependence on the temperature. Studies were also made of the solid solutions in $BaTiO_3-BaNbO_{3.5}(BaTaO_{3.5})$. The comparatively small dependence of dielectric penetration on the temperature and field intensity, absence of volatile components, and low sintering temperature indicate wider use of these solid solutions in the industry. (R.V.J.)

10075

ON SOME PROPERTIES OF $PbTiO_3$ MONOCRYSTALS AND MONOCRYSTALS OF SOLID SOLUTIONS OF (Ba, Pb)TiO_3. E. G. Fesenko, O. P. Kramarov et al. (Molotov Rostov-on-Don State Univ. Physico-Mathematical Research Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 305-10(1957) Mar. (In Russian)

Studies were made of properties of (Ba, Pb)TiO_3 monocrystals prepared from the fusion of sodium silicate and lead metaborate. All prepared crystals had a perovskite structure with a tetragonal cell. An increase in the spontaneous deformations was observed with additions of Pb. The thermal distribution of the $PbTiO_3$ and the solid solution of (Ba, Pb)TiO_3 parameters indicated to phase transitions in the first order. In some compounds the dielectric penetrations at curie point exceeded 20 times the value at room temperature. The hysteresis loops and the reverse penetration properties confirmed the existence of extensive internal field. (R.V.J.)

10076

DIELECTRIC PENETRATION OF NIOBATES AND TAN-

TALATES OF DIVALENT METALS. V. A. Isupov (Inst. of Semiconductors Acad. of Sciences U.S.S.R.). Izvest Akad. Nauk S.S.S.R. 21, 402-10(1957) Mar. (In Russian)

10077

THERMAL LENGTH CHANGES OF SOME REFRACTORY CASTABLES. S. J. Schneider and L. E. Mong. J. Research Natl. Bur. Standards 59, 1-8(1957) July.

The changes in length exhibited by a variety of refractory castables during complete heating and cooling cycles were determined. The tests consisted of determinations on castable specimens that had been heat treated at either 110, 1,050, or 1,300°C. A detailed description of the apparatus is given, especially that of the dilatometer assemblies. These assemblies incorporated differential transformers to give a record of length changes as they occurred. The data suggested that the same general length-change characteristics were exhibited by castables that had received the same curing and heat treatment. Length-change curves of all three groups illustrated silica inversions. Curves of the 110°C group indicated contractions associated with cement reactions, namely, the loss of water of hydration and the conversion of amorphous alumina to γ alumina. (auth)

CORROSION

10078 AERE-M/M-41 (Rpt: UNCLASSIFIED)

Gt. Brit. Atomic Energy Research Establishment, Harwell, England.

CORROSION OF ZIRCONIUM. EXPLORATORY TESTS ON TANTALUM AND NIOBIUM ALLOYS IN DISTILLED WATER. R. A. U. Huddle and C. F. Britton. Feb. 1952. Decl. Apr. 2, 1957. 4p.

Corrosion of Zr, Nb, and Ta alloys in distilled water at 200 and 300°C is discussed. (W.L.H.)

10079 IDO-16338

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

FAILURE OF WAPD-30 HIGH PRESSURE LOOP. M. S. Robinson. Apr. 19, 1957. 11p. Contract AT(10-1)-205. $0.15(OTS).

The WAPD-30 high pressure loop consisted of an AISI Type 316 Stainless Steel tube having an O.D. of 3.50 inches and an I.D. of 2.90 inches. After approximately three months and 2,060 Mwd service in the MTR at a temperature of 600°F and a pressure of 2200 psig the tube developed a leak which necessitated its removal from service. Water and NO_2 gas were known to have collected in the annulus surrounding the tube and observation of the failed tube tip indicated a liquid type corrosive attack from the outside of the tube. NO_2 formation during operation and moisture collection in the annulus during shutdown periods together with boiling during the startup of the loop probably concentrated the existing HNO_3 into the constant boiling and fuming range of concentration. The corrosion of type 316 Stainless Steel in constant boiling or fuming HNO_3 exceeds 50 mils per year and its use, under these circumstances, would be questionable; however, the approximate 1000 mils per year corrosion rate for the WAPD-30 tube would not be expected. The additional corrosion rate of the WAPD-30 tube can probably be attributed to the operation temperature and pressure, non-continuous type of operation and the unknown effects of neutron and gamma irradiation. (auth)

10080 KAPL-M-GEG-9

Knolls Atomic Power Lab., Schenectady, N. Y.

CORROSION OF SPRING MATERIALS IN HIGH TEMPERATURE WATER. G. E. Galonian and H. L. Tymchyn. Apr. 24, 1957. 18p. Contract W-31-109-Eng-52. $3.30 (ph OTS); $2.40 (mf OTS).

Helical springs of Inconel-X, Haynes 25, and Allegheny A286 were corrosion tested unstressed and stressed in compression for periods up to six months in 600 and 680°F water. The purpose of these tests was to determine the rate of corrosion and resistance to stress corrosion cracking under conditions expected in the S3G/S4G control drive mechanisms. The results of static autoclave tests showed that the most corrosion resistant material investigated was Haynes 25. The rate of corrosion of Inconel-X was higher than Haynes 25 but both material should be suitable for use in the water conditions investigated. The presence of dissolved air in the test water increased the total amount of corrosion of all the materials but did not produce stress corrosion cracking. Both Cr and Co–W coatings on Inconel-X were attacked in air saturated water. (auth)

10081 KAPL-M-JMG-8

Knolls Atomic Power Lab., Schenectady, N. Y.

CORROSION RESISTANCE IN 680°F WATER OF TYPE 304 STAINLESS STEEL BRAZED JOINTS. J. M. Gerken. Mar. 29, 1957. 13p. Contract W-31-109-Eng-52. $3.30 (ph OTS); $2.40 (mf OTS).

The corrosion resistance of several brazing alloys suitable for brazing type 304 stainless steel was determined qualitatively. The corrosion resistance in 680°F SAR water of all brazes was good. Some brazing materials exhibited superior corrosion resistance in 680°F water. These were a Ag–Cu eutectic BT, pure Cu, pure Au, Au with 20% Cu, Au with 18% Ni, Cu with 20% Pd and 3% In, 65% Pd–35% Ni, and ANP-81. (auth)

10082

THE FORMATION OF FILMS ON ALUMINIUM IMMERSED IN WATER. R. K. Hart (Univ. of Cambridge). Trans. Faraday Soc. 53, 1020-7(1957) July.

High-purity aluminum, when subjected to total immersion at 20 to 80° C in pure water, carries surface films which are either "amorphous" or crystalline hydrates. Below a critical temperature, between 60 to 70° C, film growth proceeds in three stages: (1) "amorphous"; (2) boehmite, γ-AlO(OH); orthorhombic, a = 3.78 A, b = 11.8 A, c = 2.85 A; and (3) bayerite, β-$Al_2O_3 \cdot 3H_2O$; monoclinic, a = 4.72 A, b = 8.68 A, c = 5.06 A, α = 90° 11′, the final film thus consisting of three layers. Above the critical temperature only boehmite films are formed on the top of the initially present amorphous film. Oriented overgrowth is favored by both boehmite and bayerite: (001) parallel to the surface for boehmite, and (010) parallel to the surface for bayerite. Immersed aluminum is almost immune to pitting; it does, however, suffer severe intergranular attack, especially above 60° C. (auth)

GEOLOGY AND MINERALOGY

10083 RME-81(Rev.)

Grand Junction Operations Office. Exploration Div., AEC.

RECONNAISSANCE OF THE CAMERON AREA, COCONINO COUNTY, ARIZONA. David N. Hinckley. June 1955. 21p. $0.25(OTS).

In the Cameron area, in north-central Ariz., a belt of Triassic sedimentary rocks dips northeast toward Black Mesa Basin. Uranium is found in the Chinle formation and the Shinarump conglomerate. Geologic criteria useful in locating U are stratigraphic position, sandy lenses, carbonaceous material, color, and traces of Mo. Chemical analysis of 5 elements from samples taken from mineralized and barren lenses indicates that Mo has a significant

relation to U distribution. A determination by field tests of the V content in samples revealed no usable criteria. No relationship appears to exist between ore deposits and fracture patterns detectable on aerial photographs. At the Huskon No. 1 mine, ore is distributed in the lower 60 ft of the "C" member of the Chinle formation in a sandy mudstone lens about 40 ft thick, which contains abundant C trash. (auth)

10084 TEI-620

Geological Survey.

GEOLOGIC INVESTIGATIONS OF RADIOACTIVE DEPOSITS. Semiannual Progress Report [for] December 1, 1955 to May 31, 1956. 361p. June 1956. $1.75(OTS).

Progress during the six-months period from December 1, 1955 to May 31, 1956 on investigations of radioactive materials in the United States and Alaska, undertaken by the U. S. Geological Survey under the sponsorship of the U. S. Atomic Energy Commission, is reported. The shift in emphasis of the Geological Survey's program from the search for minable deposits as such toward the understanding of geologic conditions favorable for U concentration was continued during the period. The exploration drilling program, which has been in progress since 1947, was concluded, and the effort is now directed toward a comprehensive understanding of the many factors involved in U geology and the publication of reports that will make available to the public information obtained in the various studies. Many investigations have progressed to the point where final reports have been completed or are in preparation for future publication with the permission of the Atomic Energy Commission; for other investigations, especially those of a continuing nature, it will be several years before final reports can be prepared. (auth)

10085

THE CANADIAN URANIUM PROSPECT. T. H. H. Skeet. Atomics 8, 262-4(1957) July.

10086

URANIUM IN BAVARIA. H. Schwandorf. Die Atomwirtschaft 2, 193-6(1957) June. (In German)

10087

SOME LIMITATIONS ON THE POSSIBLE COMPOSITION OF THE ORE-FORMING FLUID. Paul B. Barton, Jr. (U. S. Geological Survey, Washington). Econ. Geol. 52, 333-53(1957) June–July.

The activity ratios of various important anions ($S^{=}$, $CO_3^{=}$, $SO_4^{=}$, OH^-, F^-, and Cl^-) in hydrothermal solutions at the time of deposition are evaluated using a simple thermodynamic technique. The ratios are interpreted in the light of the mineralogy of ore deposits and limits are placed on the variability of each ratio in hydrothermal solutions. All of the calculations are made for 25° C and cautious extrapolation to higher temperatures seems justified; however, additional data for elevated temperatures and pressures are needed before more than approximate values may be assigned to these ratios in the ore-forming fluid. The calculated partial pressure of CO_2 in the ore fluid is generally less than one atmosphere, which suggests that a dense CO_2 phase cannot be considered an important ore fluid for more deposits. The partial pressure of H_2S is usually less than 10^{-4} atmosphere, which makes it extremely difficult to defend the theory that metals (other than the easily complexible mercury, arsenic, antimony, and perhaps gold and silver) are transported in quantity as complex sulfides or hydrosulfides. The sulfate to sulfide ratio is such that the oxidation potential at the time of deposition is defined by the following equation: Eh (in volts) = 0.22 ± 0.04 – 0.059 pH. (auth)

METALS AND METALLURGY

10088 BMI-1188

Battelle Memorial Inst., Columbus, Ohio.

AN INVESTIGATION OF URANIUM SOLID SOLUBILITY IN THORIUM. Arthur A. Bauer, Frank A. Rough, and Ronald F. Dickerson. May 29, 1957. 11p. Contract W-7405-eng-92. $0.20(OTS).

A study was performed to determine the solid solubility of U in Th. Metallographic, hardness, x-ray diffraction, and electrical-resistivity data were obtained. Metallographic determination of solid-solubility limits was hampered by an inability to differentiate between small amounts of U and contaminant inclusions, despite the use of iodide Th in the investigations. Hardness was found to increase with increasing U content up to between 3 and 5 wt. % U. The composition at which the hardness reaches a plateau does not coincide with the limit of solubility. On the basis of electrical resistivity and x-ray-diffraction data, solubility of U in Th lies between 1.5 and 2 wt. % U at 1000°C and between 0.5 and 1 wt. % U at 800 and 900°C. At temperatures below 800°C, solubility is less than 1 wt. % U. (auth)

10089 HW-36125

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

AN ABRASIVE CUTOFF MACHINE FOR METALLURGICAL RESEARCH ON RADIOACTIVE MATERIALS. C. L. Boyd. Jan. 5, 1957. Decl. July 8, 1957. 13p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

An abrasive cutoff machine was developed for the submerged sectioning of radioactive materials for metallurgical, chemical, and physical investigations without undue personnel exposure. The sectioning of fuel elements with the cutoff machine has provided valuable information concerning the extent of fuel element failures and the degree of fuel element quality. (J.E.D.)

10090 NMI-1177

Nuclear Metals, Inc., Cambridge, Mass.

THE DIFFUSION OF OXYGEN IN ZIRCONIUM AND ITS RELATION TO OXIDATION AND CORROSION. J. Paul Pemsler. May 31, 1957. 49p. Contract AT(30-1)-1565. $0.35(OTS).

The diffusion of O_2 in Zr and dilute Zr alloys was studied in the temperature range of 400 to 585°C by observing the rates of dissolution of anodically deposited interference oxide films. The diffusion coefficient of O_2 in Zr depends on the grain orientation and varies by a factor of two among different orientations. Macroscopically observed average values obey the equation D, $cm^2/sec = 9.4 \exp[(-51{,}780 \pm 220)/RT]$, where the activation energy for the diffusion of O_2 in Zr is 51.8 kcal/mole. No macroscopic differences were observed in the diffusion coefficients of the various dilute alloys. The effect of alloying additions and heat treatment on diffusion rates of individual grains is discussed. Oxidation and corrosion rates were observed to have an orientation dependence similar to that observed in the diffusion study. The mechanism of oxidation and corrosion is discussed in terms of diffusion of O_2 and adherence of oxide films. (auth)

10091 WAL-132/24

Watertown Arsenal Lab., Mass.

METALLOGRAPHIC METHODS. COLOR STAINING OF TITANIUM AND ITS ALLOYS. Ralph H. Hiltz, Jr. Apr. 20, 1956. 15p. DA Project 5B9-308-021.

10092 WAL-401/65-39

Carnegie Inst. of Tech., Pittsburgh.

RESEARCH AND DEVELOPMENT ON DETERMINATION

OF COEFFICIENTS OF FRICTION BETWEEN DRY METALLIC SURFACES. Interim Technical Report No. 1. Eber W. Gaylord and Hunter Shu. Apr. 1, 1957. 17p. D/A Project No. 5A12-15-003. Contract DA-36-061-505-ORD-545.

The determination of coefficients of static friction between dry metallic surfaces under high normal pressures, and coefficients of kinetic friction under high normal pressures and high sliding velocities are discussed. For normal pressures ranging from 1500 to 12,000 PSI coefficients of static friction have been determined for mild steel rubbing on mild steel Ti RC 130 B rubbing on mild steel, Ti RC 130 B rubbing on U, U rubbing on U, Be rubbing on U, and Be rubbing on Ti. Results show that the coefficient of static friction depends on the amount of rubbing that has taken place between the two samples. (auth)

10093

THE ANNEALING OF POINT DEFECTS IN COLD-WORKED MOLYBDENUM. D. G. Martin (Atomic Energy Research Establishment, Harwell, Berks). Acta Met. 5, 371-6(1957) July.

The change in electrical resistance on annealing cold-worked molybdenum has been studied. It is proposed that a point defect, produced by cold work, anneals at 150°C with an energy of migration of 1.26 ± 0.04 ev but that other more complex processes anneal simultaneously. (auth)

10094

NEW PROCESS FOR TITANIUM. Chem. Eng. Progr. 53, 94(1957) July.

A new process for the production of $TiCl_4$ from low-grade ore or scrap at low temperatures was considered to have wide importance in increasing the utilization of the high-potential metal in process industries. (J.E.D.)

10095

THE METALLO-CHEMICAL TABLE OF CHEMICAL ELEMENTS. I. I. Kornilov (Backov Inst. of Metallurgy, Acad. of Sciences U.S.S.R.). Doklady Acad. Nauk S.S.S.R. 114, 106-9(1957) May 1. (In Russian)

The table allows the determination of possible formations of solid solutions and metallic and ionic compounds for each metal in the periodic table and shows which metals do not form solid solutions or compounds. The table also helps to classify various types of chemical interactions of metals in the formation of alloys. (R.V.J.)

10096

HOW TO BRAZE TITANIUM. Harry Schwartzbart (Armour Research Foundation, Chicago). Iron Age 180, No. 5, 100-3(1957) Aug.

Various methods of brazing Ti are discussed. Each system has its advantages and drawbacks. The choice of heating methods, type of filler metal, and selection of atmospheres and fluxes were found to be more critical than in brazing other metals. (J.E.D.)

10097

THE EQUILIBRIUM BETWEEN TITANIUM METAL, $TiCl_2$, AND $TiCl_3$ IN NaCl–KCl MELTS. Warren C. Kreye and Herbert H. Kellogg (Columbia Univ., New York). J. Electrochem. Soc. 104, 504-8(1957) Aug.

The equilibrium between solid titanium metal, di-, and trivalent titanium chlorides dissolved in an NaCl–KCl melt was measured under carefully controlled experimental conditions. Divalent titanium was found to be the predominant valence state in the melt, for temperatures of 700 to 800°C. The "apparent" equilibrium constant (mole fractions replacing activities) for the reaction $TiCl_3$ (NaCl-KCl melt) + $\frac{1}{2}$ Ti°(c) = $\frac{3}{2}$ $TiCl_2$ (NaCl-KCl melt) was calculated and found to be a function of the total titanium concentration in the melt. Limited data indicated that the equilibrium is exothermic in agreement with expectation. (auth)

10098

CONCERNING AN ORDER-DISORDER TRANSITION IN THE Ni–Cr SYSTEM. B. W. Roberts (General Electric Co., Schenectady, N. Y.) and R. A. Swalin (Univ. of Minnesota, Minneapolis). J. Metals 9, 845-6(1957) July.

10099

CONSTITUTION OF DELTA-PHASE ALLOYS OF THE SYSTEM U–Zr–Ti. H. A. Saller, F. A. Rough, A. A. Bauer, and J. R. Doig (Battelle Memorial Inst., Columbus, Ohio). J. Metals 9, 878-81(1957) July.

The ternary section between the intermediate δ-phase alloys of the U–Zr and U–Ti systems has been investigated. A constitutional diagram for the section, ranging from U–74 at.% Zr to U–35 at.% Ti, is proposed. Thermal, metallographic, and x-ray data were obtained for alloys in this composition range. The section exhibits features of a quasibinary system in that only one and two-phase regions were found at the temperatures investigated. No evidence for a three-phase region or a new phase, not found in the binary systems, was indicated. At elevated temperatures the three components exhibited complete solubility to form the body-centered-cubic γ phase, decomposing at about 560°C to the U–Zr and U–Ti δ phases in an apparent eutectoid reaction. (auth)

10100

ELECTROLYTIC REFINING OF TITANIUM. R. S. Dean (Chicago Development Corp.). Light Metal Age 20-3(1957) Apr.

A process is described for electrorefining Ti by the discovery of a new electrolyte containing the two lower chlorides of Ti and a significant concentration of dissolved alkalinous metal. The electrolyte enables Ti to be dissolved at the anode and crystallized adherent to, but not deposited on, the cathode. (auth)

10101

TITANIUM TUBING. Thomas M. Krebs (Babcock & Wilcox Co., Beaver Falls, Penna.). Metal Progress 72, 82-7 (1957) July.

Seamless titanium tubing is available in a wide range of sizes in A-40, A-55, or A-70 grades with extruded and ground or machined surfaces or cold finished. Welded and cold finished tubing is also available. Alloy tubing may be obtained in the extruded and heat treated condition. The outstanding resistance of titanium to many chemicals, such as chlorides, indicates a large future use in the chemical and process industries. (auth)

10102

INVESTIGATION OF THE ROLLING AND RECRYSTALLIZATION TEXTURE OF Al. I. TEXTURE OF COLD-ROLLED PURE Al. Kurt Lucke. Z. Metallk. 45, No. 2, 86-92(1954). (In German)

10103

RECRYSTALLIZATION HARDENING OF Al–Mg ALLOYS. Otto Dahl and Klaus Detert. Z. Metallk. 46, No. 2, 94-9 (1955). (In German)

10104

STUDIES OF ZIRCONIUM–BORON PHASE DIAGRAM. I. ON THE FORMATION OF SOLID SOLUTION OF BORON IN ZIRCONIUM. V. A. Epel'baum and M. A. Gurevich (Karpov Moscow Physico-Chemical Inst.). Zhur. Tekh. Fiz. 31, 708-11(1957) Mar. (In Russian)

Investigations revealed that in Zr–B system zirconium dissolves up to 2 at.% of boron with a change in lattice parameters from a = 3.232 A, C = 5.140 A, c/a = 1.590 to a = 3.253 A, C = 5.191 A, c/a = 1.596. (tr-auth)

PHYSICS

10105 AECU-3487
Washington Univ., St. Louis.
A PRELIMINARY STUDY OF THE EFFECT OF TEMPERATURE ON HIGH-VACUUM ELECTRICAL CONDUCTION (thesis). Edmund Kugler Storms. Jan. 1957. 42p. [Contract AT(11-1)-85, Project No. 8.] $6.30(ph OTS); $3.00(mf OTS).

The effect of temperature on the maximum voltage after extensive bakeout has revealed two regions of different temperature sensitivity. When the system was held at various temperatures for a time long enough to insure temperature equilibrium between anode and cathode, the voltages at the lower temperatures were found to be unaffected by changes in temperature. However, at the higher temperatures a region of strong temperature sensitivity was noticed. The transition temperature between the two regions as well as the voltages in the temperature-insensitive region were found to depend on the anode size and on the source strength. The voltage in the temperature-sensitive region appeared to be unaffected by anode size, source strength, and electrode fields. Heating and cooling experiments were performed to determine whether the temperature effect depended primarily on the anode temperature or on the cathode temperature. Within the range and accuracy of the experiment, the temperature effect seemed to be confined to the anode or rod. Attempts to obtain very high voltages by rigid exclusion of organic contamination gave only limited success. A maximum of 350 kv was obtained. (auth)

10106 AECU-3489
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
THE MEASUREMENT OF THE VELOCITY OF SOUND IN A LIQUID CONTAINING GAS BUBBLES. Technical Report No. 1. Henry B. Karplus. Feb. 25, 1957. 20p. Project No. A-097. Contract AT(11-1)-527. $3.30(ph OTS); $2.40(mf OTS).

Suitable conditions were considered for determining the velocity of sound in liquids containing gas bubbles. The basis for the computation is Wood's formula relating the velocity of sound to the volumetric gas concentration. The formula is expected to fail near the resonance frequency of the largest gas bubbles, consequently experimental convenience requires bubbles of very small size. Various techniques of actually producing the medium were tried. The most successful consists of direct injection of air through porous material into a stream of rapidly moving fluid containing small traces of surface active agents. Concentrations were measured gravimetrically and about 4% air was achieved in a 30 gal. tank. Of the many possible techniques to measure sound velocity, standing waves in pipes and time of flight methods appear most promising. Very rough preliminary measurements using the latter technique confirm Wood's formula qualitatively. (auth)

10107 AECU-3507
Sandia Corp., Albuquerque, N. Mex.
APPLICATION OF THIN PRINTED WIRING LAMINATE IN ELECTRONIC PACKING. George Voida. [Oct. 3, 1956]. 36p. Contract [AT(29-1)-789]. $6.30(ph OTS); $3.00 (mf OTS).

The use of flexible printed circuits in electronic packaging applications is discussed. The wiring is printed on very thin copper-clad laminates consisting principally of epoxy resins and reinforcement materials. Specifically considered are the types of materials and their availability, conductor-laminate bond strength properties, shaping characteristics, and processing and operating stability. (auth)

10108 CF-56-10-139
Oak Ridge School of Reactor Technology, Tenn.
STRESS ANALYSIS FOR ORSORT STUDENTS. Second Edition. C. O. Smith. Oct. 1956. 375p. $1.75(OTS).

10109 ISC-687
Ames Lab., Ames, Iowa.
MULTI-BAND ELECTRICAL CONDUCTION. John Browning Gibson and Joseph M. Keller. Aug. 1955. 51p. Contract W-7405-eng-82. $0.35(OTS).

Scattering amplitudes arising from lattice vibrations are calculated for electrons in a transition metal, with special reference to Ni. The potential in the crystal is treated as a deformable potential, with corrections to adjust the zero of potential and to include effects of the redistribution of charge during lattice vibration. The distinction between normal and Umklapp processes is not a sharp one when a deformable potential is assumed. Rather, the scattering gradually takes on more of an Umklapp character as the wave length of the phonon decreases. The 4s electrons are treated in the weak binding and 3p electrons in the strong binding approximation. For s-s scattering, the Umklapp amplitude is larger than normal amplitude by roughly the ratio (kinetic energy at the bottom of the band)/(Fermi energy), or about 8. This makes back-scattering unreasonably likely, and indicates that the method is probably not accurate for large angle scattering. Scattering amplitudes for s-d scattering are of the same order as for s-s scattering in the forward direction. The dependence of s-d amplitude on the various angles is explored. (auth)

10110 NAVORD-3901
Naval Ordnance Lab., White Oak, Md.
AN OPTICAL SHOCK VELOCITY MEASURING SYSTEM FOR THE SHOCK TUBE. Robert L. Varwig. Feb. 11, 1955. 14p.

A shock-velocity measuring system which employs two schlieren optical systems with photomultiplier tubes as detectors is described. Briefly, the schlieren systems each produce an electrical signal as the shock passes. The time interval between the signals is measured by a Potter Electronic Counter Chronograph. The distance separating the schlieren systems is measured and the velocity computed. The maximum uncertainty in the measurement of shock velocity is 0.3%. (auth)

10111 NYO-7918
Aeroprojects Inc., West Chester, Penna.
APPLICATIONS OF ULTRASONIC ENERGY. Progress Report No. 4 Covering Period from April 16, 1957 to June 15, 1957. June 1957. 33p. Contract AT(30-1)-1836. $6.30(ph OTS); $3.00(mf OTS).

Direct-coupling ultrasonic dissolution experiments with Type 304 stainless steel in HNO_3–HCl mixtures resulted in the following dissolution rates: in a solution of 5M HNO_3 + 0.5M HCl, rates of 10 to 25 mg/cm^2/min; in 2M HNO_3 + 0.25M HCl, rates of 2 to 4 mg/cm^2/min; and in 2M HNO_3 + 0.1M HCl, rates of 2 to 3 mg/cm^2/min. Optimum HNO_3 concentration for the latter system is yet to be determined. Effective dissolution of a small number of carburized stainless steel coupons in HNO_3 solutions both with and without urea was also obtained. Experiments with Zircaloy-2 in exploratory dissolving media indicated an appreciable increase in dissolution rate in fluoboric acid under ultrasonic influence. Ultrasonic energy applied to Th–Bi mixtures during cooling from 1000 to 500°C effectively prevented the formation of the usual thorium bismuthide platelets. At 450 to 500°C, previously formed platelets were fractured into small particles. At 500°C, equiaxed

particles were markedly reduced in size, and the reaction of Th and Bi at this temperature appeared to be accelerated. Initial efforts to treat compacts of H-reduced iron powder with elastic vibratory energy by means of a transducer-coupling system delivering energy in the lateral mode resulted in fracture of the die insert during first tests at 100 tons force. (auth)

10112 SC-4036(TR)

Sandia Corp., Albuquerque, N. Mex.

EFFECT OF DRAG AND LIFT ON THE RELATION BETWEEN TORQUE AND ROTATION OF A CROSSED-FLEXURE PIVOT. F. G. Blottner. Dec. 21, 1956. 19p. Contract AT(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

Static- and dynamic-stability data, as determined with a wind-tunnel model supported on crossed flexures, can be seriously in error, due to changes in the flexure spring constant caused by model lift and drag forces. A theory analyzing this effect, together with corroborating experimental data, is presented. (auth)

10113

PREPARATION OF INFINITELY THIN PLUTONIUM SOURCES BY ADSORPTION. M. A. El Guebely and T. Sikkeland (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). Acta Chem. Scand. 11, 473-8 (1957).

Infinitely thin sources have been prepared by adsorption of Pu^{239} from hydrochloric acid solutions onto glass, aluminum, and platinum surfaces. The validity of the method was studied by autoradiography. Results show that glass and aluminum are the best surfaces for such sources of U^{233} on glass. Segregation of Pu and U has been observed on glass as well as on metallic surfaces. (auth)

10114

RADIO-ANALYSIS OF KRYPTON AND XENON AND ITS USE IN DIFFUSION EXPERIMENTS WITH SILVER. J. M. Tobin (Hanford Atomic Products Operation, Richland, Wash.). Acta Met. 5, 398-403(1957) July.

A method has been evaluated which is capable of analyzing relative concentrations of krypton and xenon gases whose total concentration is in the range of 10^{-10} to 10^{-8} gram atoms. The necessary gas collection and gas-transfer apparatus is described. Krypton-85 and Xe^{133} are produced by neutron irradiation, and their activities are counted with a gamma spectrometer. The isotopes are identified by the energy of their gamma radiations and by their disintegration half lives. The use of the radioanalysis technique for the determination of diffusion coefficients of krypton in silver has proven successful. The equipment used in diffusing the gas and in collecting and analyzing the gas samples is described. The values of diffusion coefficients at 500, 600, 700, 735, and 800° C are given. These values can be represented by the equation $D = 1.05 \exp(-35{,}000/RT)$ cm^2/sec. Thus, the activation energy for the diffusion of krypton in silver is 35 kcal per gram atom. (auth)

10115

EQUATIONS GIVE LIQUID HEAT CAPACITIES. Wallace R. Gambill (Union Carbide Chemicals Co., Charleston, W. Va.). Chem. Eng. 64, No. 8, 257-8(1957) Aug.

10116

APPLICATION OF RADIOACTIVE SUBSTANCES FOR REMOVAL OF ELECTROSTATIC CHARGES. H. Haase. Die Atomwirtschaft 2, 186-8(1957) June. (In German)

10117

ON THE OPERATING TEMPERATURE OF ARTIFICIAL SATELLITE. A. G. Karpenko and M. L. Lidov. Izvest. Acad. Nauk S.S.S.R. Ser. Geofiz. 527-33(1957) Apr. (In Russian)

Calculations were made of the satellite temperature in motion with the assumptions that the body possesses an infinite heat conductivity and that it is not oriented in the space. The internal heat energies contributed by sun radiation and the earth as the heat radiation reflected from the sun were considered. Results presented in graphical form show that the satellite temperatures with small internal sources of energy fluctuate from 0 to 10°C. (R.V.J.)

10118

THE LOCATION OF EVENTS IN NUCLEAR EMULSIONS. J. H. Fremlin and J. Mathieson (Univ. of Birmingham, Eng.). J. Sci. Instr. 34, 287-9(1957) July.

Two methods of fixing locator coördinates to nuclear emulsions are described. One involves the pouring of a new emulsion on the glass side of the processed and dried event-bearing emulsion and printing on it with a grid negative. In the other method the grid is printed directly on the bottom of the main emulsion through the glass support and developed during the normal processing. (T.R.H.)

10119

MEASUREMENT OF THE DENSITY OF LIQUID RUBIDIUM. Stanley Cohen (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, 530-1(1957) July.

Density measurements were made on liquid rubidium, and the results are represented by the equation $\rho(g/cc) = 1.52 - 0.00054\,(T - 39°C)$, where T is the liquid temperature in °C. Data were taken from the melting point, 39°C, to about 400°C; however, the equation should hold to the boiling point, 688°C. An error analysis indicated that the values reported are within 1.5% of the true values. The liquid density value of 1.52 g/cc obtained at the melting point substantiates to 3% the value of 1.475 g/cc predicted earlier. The determination was made using the buoyancy principle for a solid suspended in a liquid. The system consisted chiefly of an analytical balance from one arm of which a plummet was suspended in the molten rubidium by a 3-mil tungsten wire. The plummets and capsule containing the melt were machined from nickel. The furnace temperature was controlled by a chromel–alumel thermocouple. Liquid temperatures were measured with two chromel–alumel thermocouples and a potentiometer. The entire system was enclosed in a dry box in which an atmosphere of argon was maintained. The argon used was passed over copper filings heated to 800°C to remove traces of oxygen and through a cold trap to remove water vapor. A chemical analysis of a sample of the rubidium used indicated an assay of at least 99.5%. (Entire paper)

10120

NEW EMPIRICAL EQUATION FOR ATOMIC MASSES. Harris B. Levy (Univ. of California, Livermore). Phys. Rev. 106, 1265-70(1957) June 15.

A new empirical equation for atomic masses has been developed. This equation has been successfully applied to atomic masses of nuclides heavier than nickel. The form used is that of an expression for the mass defect, $\Delta M = M - A$, as a function of Z and A: $\Delta M(A,Z) = \alpha_0 + \alpha_1 A + \alpha_2 Z + \alpha_3 AZ + \alpha_4 Z^2 + \alpha_5 A^2 + \delta$. Because of the effects of nuclear shell structure a different set of coefficients is necessary for the different nuclear shell regions. Atomic masses calculated from this equation agree with experimental mass values to within ±0.5 millimass units in 75% of the 340 nuclides studied and agree to within ±1.5 millimass units in 95% of the nuclides. Beta-decay energies were calculated with the new equation and checked against a total of 179 experimental values. Agreement of calculated values with experiment was better than ±0.5 Mev in 95% of the cases and within ±0.25 Mev in 84%. (auth)

10121
USE OF IRON FILINGS IN A HIGH-VISCOSITY MEDIUM FOR MAPPING APPROXIMATE MAGNETIC FIELD SHAPES. Joseph B. Rechen and John C. Jordan (Univ. of California, Berkeley). Rev. Sci. Instr. 28, 584(1957) July.

Refer also to abstract 9914.

AEROSOLS

10122 BNL-2737
Brookhaven National Lab., Upton, N. Y.
FILTER SAMPLERS FOR FIELD USE. Maynard E. Smith, Frederick E. Bartlett, and George W. Potts. Mar. 31, 1956. 12p. $3.30(ph OTS); $2.40(mf OTS).

The atmospheric diffusion studies at Brookhaven National Laboratory have led to the development of a variety of samplers. The filter units and techniques described have many features in common with others reported on within recent years, but it is believed that they embody substantial advantages in accuracy, speed, and cost. Of particular interest are the two airborne samplers, which are lighter and simpler to use than any known to the authors. Although the oil-fog test effluent is not suitable for a wide range of applications, a complete description of the fluorimetric analytical method is included, emphasizing the need for meticulous care in the entire sampling procedure. (auth)

10123 NYO-4612
Harvard Univ., Boston. School of Public Health.
EVALUATION OF AN EXPERIMENTAL FRENCH WET SCRUBBER "SOLIVORE". Edward Kristal, Richard Dennis, and Leslie Silverman. Mar. 29, 1957. 57p. Contract AT(30-1)841. $0.40(OTS).

Performance tests were conducted on an experimental model of a French wet scrubber called the "Solivore." This unit (600 cfm capacity) consists of four similar collection stages in series, each containing two $1\frac{1}{2}$ hp spray generators rated at 9 gpm and 7 psi, and a special Venturi tube. A distinctive feature of this device is the spray generator which uses a rotating mechanical interrupter to disintegrate small liquid jets. Weight collection efficiencies were obtained with several aerosols for inlet dust loadings ranging from 0.02 to 2 grains/cu. ft., water rates of 6 to 12 gpm per spray generator and for one, two, and three stage operation. Efficiencies determined for a single stage varied from 99% for resuspended fly ash to 22% for iron oxide fume. Coarse and fine sulfuric acid mists were collected at efficiencies of 95% and 5%, respectively. Collection efficiency for SO_2 in low concentrations (130 mg/m^3) averaged 91% with three stages. Efficiency varied directly with the number of collection stages and water rate and inversely with the gas flow through the unit. Total pressure loss for one stage operation (including droplet eliminator) was 4.5 in. of water at rated capacity. An additional pressure loss of 2 to 3 in. of water per collection stage was observed for multi-stage operation. (auth)

COSMIC RADIATION

10124 AECU-3506
Iowa. State Univ., Iowa City.
STUDY OF GEOMAGNETIC CUT-OFF ENERGIES AND TEMPORAL VARIATION OF THE PRIMARY COSMIC RADIATION. Frank B. McDonald. Apr. 1957. 37p. (SUI-57-8). $6.30(ph OTS); $3.00(mf OTS).

The results of a series of 6 Skyhook balloon flights with combination Cherenkov-scintillation detectors, similar to ones previously described, were used to study spectral cut-offs as a function of latitude and to observe some aspects of temporal variations at high altitude of the alpha particles of the primary cosmic radiation. Observed cut-off energies were found to be in strong disagreement with geomagnetic theory. In one large cosmic-ray decrease the very low-energy portion of the cosmic-ray energy spectrum (300 to 600 Mev/nuc) does not seem to be strongly affected. (auth)

10125
MEASUREMENT OF THE ALPHA PARTICLE FLUX AT 41° N GEOMAGNETIC LATITUDE USING NUCLEAR EMULSIONS. B. J. O'Brien and J. H. Noon (Univ. of Sydney, Australia). Nuovo cimento (10) 5, 1463-8(1957) June.

Values obtained for the α-particle flux by counter measurements at 41° N over the U.S.A. are significantly higher than those obtained using nuclear emulsions at 41° N over Sardinia. The α-particle flux at 41° N over the U.S.A. using nuclear emulsions were measured, and the results, in agreement with counter measurements, are higher than those over Sardinia. These measurements are of interest in view of the proposed modifications to geomagnetic co-ordinates. (auth)

10126
EXPERIMENT ON THE PENETRATING SHOWERS PRODUCED BY μ MESONS IN A LARGE WILSON CHAMBER UNDERGROUND. D. Kessler and R. Maze. Nuovo cimento (10) 5, 1540-63(1957) June. (In French)

10127
THE FLUX OF PRIMARY COSMIC RAY α-PARTICLES OVER SARDINIA. H. H. Aly and C. J. Waddington (H. H. Wills Physical Lab., Bristol, Eng.). Nuovo cimento (10) 5, 1679-84(1957) June.

The flux of α particles in the primary cosmic radiation has been determined over Sardinia, geomagnetic latitude, λ, 41° N. A nuclear emulsion technique was employed. The result obtained of 72 ± 9 α particles/m^2.sr.s, was considerably higher than the only other directly comparable experimental result, but was in good agreement with the predicted value. The implications of this result are discussed. (auth)

10128
OBSERVATIONS ON EXTENSIVE AIR SHOWERS. III. THE DISTRIBUTION OF CHARGED PARTICLES. T. E. Cranshaw, W. Galbraith, and N. A. Porter (Atomic Energy Research Establishment, Harwell). Phil. Mag. (8) 2, 891-9 (1957) July.

The distribution of charged particles in air showers containing 3×10^6, 3×10^7, and 10^8 particles at sea level has been measured and compared with theoretical calculations by Nishimura and Kamata. The best value of the age parameter S appears to be 1.4. The significance of this result is briefly discussed. (auth)

10129
OBSERVATION ON EXTENSIVE AIR SHOWERS. IV. THE LATERAL DISTRIBUTION OF PENETRATING PARTICLES. N. A. Porter, T. E. Cranshaw, and W. Galbraith (Atomic Energy Research Establishment, Harwell). Phil. Mag. (8) 2, 900-9(1957) July.

The lateral distribution of the penetrating component has been measured in showers containing more than 3×10^6 charged particles. Between 300 and 500 meters, the distribution follows a power law with exponent 1.5, and falls more steeply beyond 500 meters. The median spread of the particles is about 500 meters. The interacting component falls off more steeply, and was not detectable beyond 150 meters. About 8.5% of all the particles are penetrating,

and of these, about 10% are interacting. The results are compared with theoretical models, and good agreement is obtained with the predictions of Rozental, based on a Fermi model of the nuclear interaction. The results appear to be in conflict with the hypothesis that the primaries of air showers might be high energy dust grains. (auth)

10130

DISINTEGRATION OF HYPERFRAGMENTS. O. Skjeggestad and S. O. Sorensen (Univ. of Oslo, Norway) and A. Solheim (Norwegian Inst. of Tech., Trondheim). Phys. Rev. 106, 1280-5(1957) June 15.

The decay of 10 hyperfragments of hydrogen, helium, and lithium is described. Only one event is uniquely identified, as $H^{4*} \rightarrow He^3 + n + \pi^-$; it gives a binding energy of the Λ^0 particle $B.E.(\Lambda^0) = 1.5 \pm 0.7$ Mev. One event represents the decay in flight of a hydrogen hyperfragment. In one case a helium hyperfragment was ejected from a star produced by a negative K meson. A very simple method for charge determination of short fragments emitted in nuclear disintegrations is described and applied to the identification of hyperfragments. (auth)

10131

MULTIPLE PROCESSES IN ELECTRON-PHOTON CASCADES. Alladi Ramakrishnan, S. K. Srinivasan, N. R. Ranganathan, and R. Vasudevan (Univ. of Madras). Proc. Indian Acad. Sci. 45, 311-26(1957) May.

Recent experiments of high-energy electron-photon cascades suggest the possibility of the following multiple processes: electron scattering with pair creation, electron scattering with the emission of two photons, and photon scattering with pair creation. The cross section for the election scattering with pair creation was recalculated by the standard Feynman technique. By use of the same technique, calculations are presented for the cross sections for electron scattering with two photon emissions and photon scattering with pair creation. (auth)

10132

AN INTERPRETATION OF THE SOLAR ANISOTROPY OF PRIMARY COSMIC RADIATION. N. W. Nerurkar. Proc. Indian. Acad. Sci. 45, 341-61(1957) May.

The present status of knowledge concerning the daily variation of meson intensity is reviewed. A solar daily variation of a constant nature arising out of a permanent anisotropy in the cosmic radiation has not so far been established and even if it exists it may not exceed a few tenths of a per cent. However a number of features of a solar daily variation of a highly variable character having on the average a time of maximum on individual days either in the early morning or near noon are known. An attempt is therefore made to interpret the occurrence of a variable anisotropy of cosmic rays to which are attributed the principal experimental observations. The present paper considers that the variable anisotropy is due to such beams, but the frozen magnetic field is derived from the magnetic field of the active solar regions and bears no preferential orientation in respect to the solar dipole field. With different orientations of the magnetic field in the beam, the component perpendicular to the solar equatorial plane could be reversed in direction. Depending upon the direction of this component, the anisotropy in the primary radiation gives rise to a daily variation at equatorial stations with maximum either in early morning hours or near noon for a group of days. With the strength of this component of the magnetic field in the range 10^{-4} to 10^{-6} gauss and the velocity of the beam between 500 and 2,000 km/sec, the daily variation of meson intensity has amplitudes from 0.3 to 1.5%. The simultaneous presence of two such beams gives rise to double the amplitudes or a daily variation with two maxima. Some further applications of this concept are discussed. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

10133

THE LATTICE CONSTANTS OF THE INERT ELEMENTS. G. H. Cheesman and C. M. Soane (Univ. of Tasmania, Hobart). Proc. Phys. Soc. (London) B70, 700-2(1957) July.

A general description of the apparatus and method used to measure the lattice constants of Xe and Kr at low temperatures is given. X rays from a commercial CA-6 type tube were used with exposures of 8 to 10 hours. Lattice constants of Xe at 58, 77.4, and 88.0°K and of Kr at 58 and 68°K are given. (M.H.R.)

10134

A NEW PHASE STRUCTURE OF MOLYBDENUM. P. S. Aggarwal and A. Goswami (National Chemical Lab., Poona, India). Proc. Phys. Soc. (London) B70, 708-10(1957) July.

It is observed that Mo deposited in a vacuum often develops a face-centered cubic structure. The deposition from a pure Mo wire was carried out for about 10 to 30 min at pressures $\simeq 10^{-4}$ to 10^{-5} mm Hg on to both rocksalt and glass substrates situated about 2 cm away from the filament. (M.H.R.)

ELECTRICAL DISCHARGE

10135 AERE-T/R-1066

Gt. Brit. Atomic Energy Research Establishment, Harwell, England.

THE THEORETICAL CHARACTERISTICS OF CONSTRICTED DISCHARGES IN MERCURY AND CAESIUM VAPOUR. W. B. Thompson and B. Burley. 1952. 27p.

Assumptions are applied in an attempt to discover a method of predicting the properties of discharges of arbitrarily high electric currents. The theory includes three free parameters corresponding to the three independent experimental variables in a d-c discharge, i.e., gas pressure, current, and tube size. Consideration is given to the effect of ionization from excited states, and the effect of ionization on electron mobility. Equilibrium ionization given by the Saha equation is tabulated for the densities and temperatures considered. The theory is applied to the determination of the characteristics of the gas discharge in Cs and Hg vapor. Data are presented graphically. (C.H.)

10136 MURA-310

Midwestern Universities Research Assn., Madison, Wis.

ELECTRONIC DEVICES USING PLASMAS IN A MAGNETIC FIELD. Tihiro Ohkawa. June 14, 1957. 17p. Contract AT(11-1)-384. $3.30(ph OTS); $2.40(mf OTS).

Electronic devices, such as linear accelerators, traveling wave tubes, klystrons and magnetrons, using the hydromagnetic wave in a plasma are discussed. Though they might not be too practical, they have interesting possibilities; for example, a linear accelerator driven by a d-c power and a method of obtaining a high temperature. There also are discussed slow devices, i.e., diodes, triodes, and junctions. (auth)

10137 UCRL-4829

California. Univ., Livermore. Radiation Lab.

A DESCRIPTION OF A SHOCK WAVE IN FREE PARTICLE HYDRODYNAMICS WITH INTERNAL MAGNETIC FIELDS. Stirling A. Colgate. Feb. 19, 1957. 20p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

The structure of an extremely strong magnetohydrodynamic shock is discussed in the limit of no particle collisions. It is tentatively concluded that the shock transition takes place through the mechanism of a strong electric field produced by charge separation. The pressure in the shocked plasma is due primarily to a very high electron

temperature. The ions, on the other hand, undergo an irreversible temperature change of only 3. (auth)

10138 UCRL-4836

California. Univ., Livermore. Radiation Lab.
MICROWAVE DIAGNOSTICS FOR HIGH-TEMPERATURE PLASMAS. Charles B. Wharton. Mar. 1957. 18p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

High-temperature plasma research, aimed mainly toward controlled thermonuclear reactions, has been greatly facilitated by the development of a number of microwave measuring techniques, called microwave diagnostics. The properties of a plasma measurable by these techniques are: average spatial density, density distribution, collision frequency, electron temperature, recombination and other loss rates, all as a function of time, with or without magnetic fields present. A wide latitude in choice of geometry and operating conditions is possible. The quantities measured directly are the phase and absorption coefficients of the dispersive propagation constant, the cyclotron frequency, bremsstrahlung radiation power and gyromagnetic radiation power. A brief theoretical derivation of the simple microwave properties of a plasma is given and experimental results indicating satisfactory correlation are presented. Experimental setups and millimeter wave equipment employed in the experiments are described. (auth)

10139 UCRL-4895

California. Univ., Livermore. Radiation Lab.
INITIAL CONDITIONS FOR THE DYNAMIC PINCH. Stirling A. Colgate. May 1957. 20p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

The experimental formation of the dynamic pinch has been an art based upon available electrical condensers, available glass and quartz tubing and an empirically determined gas pressure range. This report attempts to correlate some of this empirical information with the processes of ionization, insulator wall heating, magnetic field penetration, and shock hydrodynamics. (auth)

10140

INVESTIGATIONS OF HIGH-FREQUENCY DISCHARGE SPARKING POTENTIAL IN GAS. S. M. Levitskiĭ (Shevchenko Kiev State Univ.). Zhur. Tekh. Fiz. 27, 970-7 (1957) May. (In Russian)

The behavior of high-frequency discharge sparking potential was studied in the frequencies and pressures in the discharge area where the mechanism of pure diffusion is replaced by electron motions in the high-frequency field. The ignition characteristics in the transition point were investigated. It is shown that electron discharge based on the pure diffusion factor and the discharge based on electron motions in high-frequency fields are different discharge types and possess different properties. (R.V.J.)

10141

SPACE POTENTIAL AND ELECTRODE PULVERIZATION IN HIGH-FREQUENCY DISCHARGE. S. M. Levitskiĭ (Shevchenko Kiev Univ.). Zhur. Tekh. Fiz. 27, 1001-9 (1957) May. (In Russian)

The electrode pulverization caused by the spatial high positive potential in a flowing high-frequency discharge was measured by a probe method and by analysis of ion energies escaping from the discharge. The possible errors of the probe method in application to high-frequency discharge were evaluated. (R.V.J.)

ELECTRONS

10142

MAGNETIC MOMENT OF THE ELECTRON. A. Petermann (CERN, Copenhagen). Nuclear Phys. 3, 689-90(1957) July.

10143

REVIEW OF THE EXPERIMENTAL EVIDENCE FOR THE LAW OF VARIATION OF THE ELECTRON MASS WITH VELOCITY. P. S. Faragó and L. Jánossy (Central Research Inst. for Physics, Budapest). Nuovo cimento (10) 5, 1411-36(1957) June.

The paper reviews the actual experiments in which the dependence of electron mass on velocity is investigated. It is found that the most precise verification of the relativistic formula follows from the fine structure doublet separation of hydrogen-like spectra. Regarding the direct experiments on the behavior of free electrons, the results do not contradict the relativistic formula, although the experimental error of the available measurements is rather high; i.e., it is in most cases comparable with the difference between theoretical formulas derived from different assumptions. Recent measurements on the velocity dependence of the mass of protons are also reviewed. (auth)

10144

A METHOD FOR CALCULATING THE ANOMALOUS MAGNETIC MOMENT OF THE ELECTRON. S. Kahana and J. C. Polkinghorne (Univ. of Edinburgh, Scotland). Nuovo cimento (10) 5, 1528-32(1957) June.

A method of calculating the anomalous magnetic moment of the electron is outlined, making use of zero-photon-energy uncrossed Compton scattering diagrams. It is illustrated by a calculation of the Schwinger term. (auth)

GASES

10145

MOVEMENT OF IONS OF VARIOUS GASES THROUGH A FINE SILVER FOIL. V. G. Telkovskiĭ and V. I. Pistunovich. Doklady Akad. Nauk S.S.S.R. 113, 1035-8(1957) Apr. 11.

The passage of H^+, He^+, C^+, and O^+ ions through 40 to 60 $m\mu$ foil was studied, and the method for preparation of the 40 $m\mu$ silver foils with crystals considerably thinner than the foil thickness is described. A large magnetic mass spectrometer, 5 m long with a beam of less than 25° and three diffusion pumps with beam catchers cooled by liquid nitrogen, was used to determine the energy losses of ions passing through the foil. The common feeding source for ion acceleration from the source and the slowing down of ions in the collector reduced the error of measuring to ~1%. The scheme of the collector is given. Measurements showed that with equal velocities, within the limit of error, the velocity limits were equal for all investigated ions, while the energy losses increased in proportion to the ion mass, which proved that transmission energies are determined by ion velocities. Evaluations were made of the number of neutral particle yields from the foil for H^+ and He^+ at $E \leq 25$ kev and for other ions at the threshold energy values. For the H^+, C^+, and O^+ ions in the investigated energy range neutral atoms composed ~70 to 80% of total number of atoms and only negligible part (~4 to 9%) of charged and neutral particles scatter on 4° angle. (R.V.J.)

INSTRUMENTS

10146 AERE-C/R-915

Gt. Brit. Atomic Energy Research Establishment, Harwell, England.
THE CONSTRUCTION AND CALIBRATION OF AN APPARATUS FOR THE DETERMINATION OF SURFACE AREAS BY LOW TEMPERATURE ADSORPTION OF ETHYLENE. B. A. J. Lister and L. A. McDonald. May 22, 1952. 15p.

The apparatus described consists of a two stage Hg diffusion pump backed by a single-stage rotary oil pump, a fractionation line containing four traps, a series of four storage bulbs, expansion line between the storage system and adsorption line, adsorption line, McLeod gage, and vapor pressure thermometer for low temperature measurement. (M.H.R.)

10147 AERE-EL/M-66

Gt. Brit. Atomic Energy Research Establishment, Harwell, England.

SOME OBSERVATIONS OF CURRENT NOISE AT VERY LOW FREQUENCIES IN HIGH VALUED FIXED RESISTORS. H. Bisby, L. H. Brown, and W. G. L. Brownrigg. Jan. 7, 1952. 12p.

Voltage fluctuations in various types of high valued fixed resistors carrying a constant current were observed and measured using an apparatus which incorporated an electro-mechanical wave analyzer. The noise was measured with a current of 10^{-6} amps flowing through fixed resistors of nominal value 10^{8} ohms, and the noise-frequency spectrum was obtained for each of six resistors in the frequency range 1.0 to 0.01 cycles per second. It was found that the different types of resistors showed marked differences as noise generators. In addition the results indicate that the noise power per unit bandwidth increases with decreasing frequency according to the expression $V^2/\Delta f = k/f^n$ where n has a value between 1.0 and 1.25. (auth)

10148 AERE-EL/R-1080

Gt. Brit. Atomic Energy Research Establishment, Harwell, England.

RELAY SCALE-OF-TWO CIRCUITS. R. C. M. Barnes. Jan. 1, 1953. 23p.

The scale-of-two is a basic element of many relay circuits, but the limited information which has been published does not indicate the numerous circuits that have been developed or assist in the choice of an appropriate circuit for each particular application. This report reviews a typical selection of relay scale-of-two circuits. (auth)

10149 POC-MEM-39

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A REVIEW OF TEMPERATURE MEASURING TECHNIQUES APPLIED TO SLUGS AND GAS COOLANT IN NUCLEAR REACTORS. J. Bowen. Sept. 7, 1950. 18p.

10150

AUTOMATIC ADIABATIC CALORIMETER SHIELD CONTROL. M. G. Zabetakis, R. S. Craig, and K. F. Sterrett (Univ. of Pittsburgh). Rev. Sci. Instr. 28, 497-501(1957) July.

An automatic adiabatic calorimeter shield control has been built and operated successfully for approximately 700 hrs. It has been used with an existent low temperature (10 to 300°K) intermittently heated calorimeter in runs of up to 100 hrs duration. Each control unit consists essentially of a difference thermocouple, high sensitivity taut suspension galvanometer, a set of four photomultiplier tubes, a relay servo mechanism, a reversible a-c motor and gear train and two ON-OFF control relays. The observed behavior of the control and the internal consistency of the data obtained during its use indicate that the precision with which it controls the shield temperature is comparable with that obtainable from a trained human operator. (auth)

10151

RADIOACTIVE UNIFORM EXTENDED SOURCES. G. W. C. Tait and R. E. Townshend (Atomic Energy of Canada Ltd., Chalk River, Ontario). Rev. Sci. Instr. 28, 542-3(1957) July.

A device is described for producing a uniform distribution of a solution of radioactive material over a large area source. Droplets of controlled size are expressed from a syringe at a constant rate and systematically and uniformly placed over an area up to 50 cm square. (auth)

10152

TESTING MACHINE FOR SHORT-TIME CREEP AND STRESS-RUPTURE TESTING AT 2000 TO 2500°C. Morton C. Smith, D. M. Olson, and Harry L. Brown (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 28, 543-7 (1957) July.

A testing machine is described in which a specimen contained within a water-jacketed vessel is heated in vacuum or in a gas atmosphere by a tantalum-tube resistance heater, and is then subjected to static tensile loads up to 100,000 psi. This machine is now in routine use at Los Alamos Scientific Laboratory for short-time creep and stress-rupture testing of metallic and nonmetallic specimens at 2000 to 2500°C. With minor modifications, it can also be used for longer-period creep and stress-rupture studies, for ordinary tensile, compressive, or shear testing, and for operation at temperatures substantially above 2500°C or down to room temperature. (auth)

10153

RETICLE-PROJECTING MICROSCOPE. W. C. Davis (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 28, 577-9(1957) July.

A modification has been made to a microscope which renders it a useful device for examining the image-forming qualities of various optical systems. The microscope can be used to produce a test pattern for the optical system under test, and at the same time to examine the image which the optical system forms of that pattern. Called a reticle-projecting microscope, the instrument is similar to a microscope with a standard vertical illuminator. (M.H.R.)

10154

HIGH-VOLTAGE LOW-IMPEDANCE DIVIDER FOR REGULATING PHOTOMULTIPLIER DYNODES. John V. Kane (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 28, 582-4(1957) July.

ISOTOPES

10155

FRACTIONATION OF SULPHUR ISOTOPES IN NATURE. Hitoshi Sakai (Univ. of Tokyo). Geochim. et Cosmochim. Acta 12, 150-69(1957).

The S^{34}/S^{32} ratios in various sulfur compounds of igneous origin were determined. The present results on the distribution of S^{34} in them are in good agreement with those found by earlier workers. The light and heavy sulfate were discriminated from their isotopic composition of sulfur. The former (S^{34}/S^{32}: 0.04406–0.04521) consists of secondary sulfates formed by the oxidation of sulfides on the ground surface, and the latter (S^{34}/S^{32}: 0.04542–0.04638) of igneous sulfates as well as oceanic sulfates. Some processes, which brought about the observed isotopic fractionation during magmatic and volcanic activity, were discussed. Possible formation temperatures of sulfates and sulfur dioxide of magmatic and exhalative origin were estimated; they are 75 to 140°C for sulfates in hot springs, 140 and 900°C for sulfur dioxide in volcanic fumaroles, and 120 to 360°C for sulfates in the epithermal ore deposits of Japan. It was also shown that the present isotopic composition of

oceanic sulfates could be interpreted by volcanic sulfur dioxide. (auth)

10156

HALF-LIVES OF RADIONUCLIDES. I. H. W. Wright, E. I. Wyatt, S. A. Reynolds, W. S. Lyon, and T. H. Handley (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, 427-30(1957) July.

Half lives of thirty radionuclides are reported. Most of the samples were chemically purified after bombardment. In general, the activity of a given sample was followed for two or more half lives, employing a gamma ionization chamber, gamma scintillation counter, or a Geiger-Mueller counter. The data were analyzed by the least squares method. Some of the half-life values are significantly different from earlier ones; others merely confirm those already established. (auth)

10157

SIMPLE LABORATORY METHOD FOR PRODUCING ENRICHED CARBON-13. Richard B. Bernstein (Univ. of Michigan, Ann Arbor). Science 126, 119-20(1957) July 19.

A simple, inexpensive laboratory method is described for producing enriched C^{13} as barium carbonate. The reaction resulting from the dehydration of formic acid with sulfuric acid was found to be suitable for C^{13} enrichment. Molar quantities of barium carbonate at an enrichment of 25%, decimolar amounts enriched to 45%, and centimolar quantities enriched by a factor of 1.5 above the natural abundance level were prepared. (C.H.)

ISOTOPE SEPARATION

10158

INFLUENCE OF THE CATHODE METAL ON THE SEPARATION OF HYDROGEN ISOTOPES. J. Brun, Th. Varberg, W. Gundersen, and R. Solli (Norwegian Inst. of Tech.). Kgl. Norske Videnskab. Selskabs Forh. 29, 5-9 (1956).

A number of separation factor determinations at various cathode materials in alkaline solution have been carried out. The initial experiments, comprising but a small number of metals, had given separation factor values higher than most of the values found in the literature for the corresponding metals. The main subject of the present investigations was the checking of the initial values and, if possible, to find an explanation for the differences observed. The determinations also included some metals for which no measurements of the separation factor could be found in the literature. (auth)

MASS SPECTROGRAPHY

10159

ISOTOPIC STANDARDS FOR CARBON AND OXYGEN AND CORRECTION FACTORS FOR MASS-SPECTROMETRIC ANALYSIS OF CARBON DIOXIDE. Harmon Craig (Univ. of Chicago, Ill.). Geochim. et Cosmochim. Acta 12, 133-49 (1957).

Seventy-four mass spectrometric analyses have been made on eight isotopic standards for carbon and oxygen. The standards reported on are the National Bureau of Standards limestone, water, and graphite reference samples, the Solenhofen standard used by Nier for absolute measurements, and the carbonate standards used by the Stockholm, Basel, Wellington, and Chicago laboratories. The basic measurements are reported as δ values relative to the Chicago PDB standard and as absolute isotope ratios. The absolute ratios are based on new figures for Nier's standard, derived from a re-evaluation of his data and new measurements on atmospheric oxygen. The correction factors for instrumental effects and for the nature of the mass spectra have been studied. Simple but precise equations for the mass spectra effects have been derived, which give the correction factors as functions of the measured differences between sample and standard. The oxygen isotopic composition of carbon dioxide produced by combustion of carbon has been studied, and the derived correction factors for carbon measurements were checked experimentally by varying the O^{18} content of carbon dioxide. (auth)

MATHEMATICS

10160 AECU-3503

Illinois. Univ., Urbana. Digital Computer Lab.

TECHNICAL PROGRESS REPORT. PART I. STUDY PROGRAM ON HIGH-SPEED COMPUTER. PART II. SWITCHING CIRCUIT THEORY. PART III. MATHEMATICAL METHODS. PART IV. ILLIAC USE AND OPERATION—GENERAL LABORATORY INFORMATION. Apr. 1957. 20p. Contracts AT(11-1)-415; N6ori-07130; and Nonr-1834(15). $3.30(ph OTS); $2.40(mf OTS).

10161 AECU-3508

Illinois. Univ., Urbana. Digital Computer Lab.

TECHNICAL PROGRESS REPORT. PART I. STUDY PROGRAM ON HIGH-SPEED COMPUTER. PART II. SWITCHING CIRCUIT THEORY. PART III. MATHEMATICAL METHODS. PART IV. ILLIAC USE AND OPERATION—GENERAL LABORATORY INFORMATION. May 1957. 17p. Contracts AT(11-1)-415; N6ori-07130; and Nonr-1834(15). $3.30(ph OTS); $2.40(mf OTS).

10162 APEX-316

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

SPECIFICATIONS FOR PROGRAM GEORGE. W. B. Henderson, B. H. Duane, R. E. Reid, and D. S. Selengut. Mar. 19, 1957. 101p. (XDC-57-5-83). $16.30(ph OTS); $5.70(mf OTS).

Detailed specifications for Program George, a general reactor program containing the basic routines necessary for the nuclear design of ANP reactors, are given. The detailed mathematical equations are included broken down into independent subroutines for maximum flexibility in coding. (auth)

10163 APEX-317

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

OFF-CENTER CONTROL ROD FLUX AND POWER DISTRIBUTION. Jacob W. Zwick. May 7, 1957. 9p. (XDC-57-5-91). $1.80(ph OTS); $1.80(mf OTS).

Supplement to DC-56-9-23.

Neutron flux and fission power distributions for a cylindrical reactor core with an off-center control rod are formulated for numerical evaluation on a digital computer. (auth)

10164 APEX-318

[General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati].

CYLINDRICAL REACTOR CORE WITH A RING OF N CONTROL RODS. Jacob W. Zwick. Mar. 8, 1957. 30p. (XDC-57-5-114). $4.80(ph OTS); $2.70(mf OTS).

The two-energy-group analysis of a cylindrical reactor core with N identical control rods arranged symmetrically on a circle concentric with the core axis is formulated for numerical evaluation on a digital computer. The effect of the control rods is expressed in terms of fast and slow albedos at the rod-core interfaces. The boundary conditions at the core outer surfaces are expressed in terms

of energy-averaged flux logarithmic derivatives at the radial core-reflector interface and at the end core-reflector interfaces. (auth)

10165 NYO-8501

Ford Instrument Co., New York.

APPLICATION OF DIGITAL TECHNIQUES TO REACTOR CONTROL SYSTEMS. Period Covered: February 1, to May 1, 1957. June 1, 1957. 23p. Contract AT(30-1)-1969. $6.30(ph OTS); $3.00(mf OTS).

A study to investigate the application of digital techniques to reactor controls is summarized. Two specific applications have been studied. A digital system to provide count rate and period information in the reactor start-up channel is described. There is also a description of a control rod position indicator based upon an electromagnetic delay line principle. There is an analysis of advantages, problem areas, and feasibility for each design. (auth)

10166 UCRL-4764

California. Univ., Livermore. Radiation Lab.

A METHOD OF SOLVING THE TWO-END-POINT PROBLEM FOR SECOND-ORDER DIFFERENTIAL EQUATIONS. James E. Faulkner. Oct. 1956. 4p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

10167

A METHOD FOR COMPUTING CERTAIN INVERSE FUNCTIONS D. R. Morrison (Sandia Corp., Albuquerque, N. Mex.). Mathematical Tables and Other Aids to Computation 10, No. 56, 202-8(1956) Oct.

A method is demonstrated for computing the inverse of certain functions. The method is applicable to the computation of logarithms and inverse trigonometric functions. It makes use of the binary expansion of real numbers and is, particularly suitable for use in automatic digital computing machines which use the binary number system. It is not recommended for hand computing. (auth)

10168

THE SCATTERING OF FAST CHARGED PARTICLES. III. ON THE SINGLE SCATTERING OF HIGH ENERGY POSITRONS AND ELECTRONS AT SMALL ANGLES. K. B. Allen, K. Phillips, and F. Whittaker (Metropolitan-Vickers Electrical Co. Ltd., Manchester). Proc. Phys. Soc. (London) A70, 536-9(1957) July.

The Mott cross section for the Coulomb scattering of electrons of velocity of β through an angle is expressed as $\sigma = 1/K_2[q^2(1-\beta^2)\ |F|^2\ \mathrm{cosec}^2\ ½\ \Theta + |G|^2\ \sec^2\ ½\ \Theta]$, where $q = \alpha/\beta$, $K^2 = M_0^2v^2/h^2(1-\beta^2)$, $\alpha = Ze^2/hc = Z/137$, $\beta = v/c$. Replacing Z by -Z gives the cross section for positron scattering. F and G have been expanded as a series in powers of β and α/β up to α^4. The values of the coefficients in these series have been summed numerically for values of Θ from 5 to 30 degrees on the Manchester University electronic computer Mk I. The result of scattering cross section calculations for angles less than 30° are given. (M.H.R.)

10169

BIBLIOGRAPHY OF RUSSIAN MATHEMATICS BOOKS. George E. Forsythe. New York, Chelsea Publishing Company, 1956. 106p.

10170

LIMIT THEOREMS FOR CONDITIONAL DISTRIBUTIONS. George P. Steck. Berkeley and Los Angeles, University of California Press, 1957. 50p. $1.50.

A partial answer to the problem of determining conditions under which the convergence of joint distributions implies the convergence of conditional distributions is given. It was shown that certain conditions of equicontinuity are sufficient to imply the desired convergence and that these conditions are satisfied in a number of cases of practical and theoretical importance. As an application of the general results, it is shown that K. Pearson's χ^2 statistic, formed from s observations distributed in n cells, has a limiting normal distribution when s tends to infinity, provided only that n/s^2 tends to zero. Another application deals with the construction of tests which are approximately similar when the number of observations taken is large. (M.H.R.)

MEASURING INSTRUMENTS AND TECHNIQUES

10171 AERE-I/M-26

Gt. Brit. Atomic Energy Research Establishment, Harwell, England.

LIMITATIONS AND EXTENSIONS OF THE COINCIDENCE METHOD FOR MEASURING THE ACTIVITY OF β-γ EMITTERS. J. L. Putman. July 13, 1953. 7p.

It has been shown that the β-γ coincidence method is valid for the measurement of extended sources, provided that either the β counter or the γ counter is equally sensitive to all parts of the source. In the elementary proof it was assumed that the activity per unit volume of the source was uniform over the source, and also that the disintegration of the source involved a single β transition followed by one or more γ rays. By an extension of the argument, it is shown that the uniformity of specific activity is not a necessary condition. The magnitude of the error which occurs when both counters depart from uniform sensitivity over the source was also deduced. Related arguments are developed to show the corrections necessary when different β-γ transitions occur in known proportions. The way in which these can be applied to the measurement of complex breakdown schemes by the coincidence method is discussed. (auth)

10172 AERE-NP/R-1594

Gt. Brit. Atomic Energy Research Establishment, Harwell, England.

HELIUM-3 FAST NEUTRON SPECTROMETER. III. THE GAS FILLING SYSTEM. R. Aves, R. Batchelor, M. J. Elliott, and A. S. H. Smith. Jan. 31, 1954. 13p.

A vacuum system suitable for filling proportional counters with mixtures of He^3, Kr, and CO_2 and for subsequently recovering all the He^3 is described. Several items, which are essential for the careful handling of this gas and have therefore been designed specially for this work, e.g., a pressure-vacuum valve, are described. (auth)

10173 ANL-5684

Argonne National Lab., Lemont, Ill.

ENVIRONMENTAL RADIOACTIVITY AT ARGONNE NATIONAL LABORATORY. Report for the Year 1955. J. Sedlet. Feb. 1957. 29p. Contract W-31-109-eng-38. $0.25(OTS).

Data are summarized on the radioactive content of samples of rain, surface water, soil, plants, and bottom silt which were collected and analyzed during 1955. (C.H.)

10174 APEX-314

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

AN INVESTIGATION OF RADIATION DOSE AND DISTRIBUTION OVER THE BODY RECEIVED WHILE WORKING IN A HETEROGENEOUS RADIATION FIELD "GROUND HANDLING." E. R. Beever. Mar. 14, 1957. 21p. (XDC-57-3-119). $4.80(ph OTS); $2.70(mf OTS).

Measurements were made of the body radiation dose received by the ground crew working in the radiation field in and around a radioactive jet engine systems panel. Doses received at various parts of the body were measured for two men working in the radiation field. It was found that the dose received was not uniform but could be

predicted when the radiation field is well known. It was also found that the total dose could be materially reduced by the use of simple selective shielding of particularly active sources and by the careful selection of materials to be incorporated in systems susceptible to irradiation. (C.H.)

10175 HW-39966

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

IODINE^{131} GAMMA SCINTILLATION MONITOR. Interim Report. A. E. Smith and G. J. Alkire. Nov. 14, 1955. 7p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

An in-line γ scintillation I^{131} monitor installed in the Hanford separations plant responds rapidly to changes of the I^{131} γ activity in the off-gas and gives immediately available information as to changes in activity levels. High background activity caused by absorption of radioactive I and Ru on the walls of the sample cell interferred with performance until a fluorothene-lined cell was installed and provisions made for routine cell rinsing. (C.H.)

10176 POC/Memo-30

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

CALIBRATION OF DUCT ACTIVITY CHAMBERS. T. E. Burnup, F. W. Fenning, and R. V. Moore. June 30, 1949. 3p.

10177 WADC-TR-56-548

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

MEASUREMENT OF RADON GAS IN CYLINDRICAL IONIZATION CHAMBERS. Edward A. Burke. July 31, 1956. 10p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: NUCLEAR EFFECTS. (AD-118062).

Three of the fundamental problems encountered in the measurement of radon gas using cylindrical ionization chambers are discussed and solutions presented. These are: variation of ionization current with short half-life radon daughters, effect of dielectric absorption, and calibration of the ionization chamber. (auth)

10178 WT-1178A

California. Univ., Los Angeles. Atomic Energy Project.

BETA SKIN-DOSE MEASUREMENTS BY SPECIALLY DESIGNED FILM-PACK DOSIMETERS. Richard K. Dickey, Louis B. Silverman, and Mary Lee Griswold. May 1957. 25p. Project 37.2 of OPERATION TEAPOT. $0.25(OTS).

A film dosimetric method for determining the beta-ray dose recieved directly below the cornified epithelial surface of the skin (7 mg/cm^2) from exposure to fall-out fission products was used during Operation Teapot. The design and construction of the special film pack required and the method of reading and interpreting the films are discussed. Nine or ten packs were used for each of the four shots of interest to Project 37.2, March 7 (Turk), March 29, (Apple I), April 15 (Met), and May 5 (Apple II). Each pack was exposed only once. In the case of the first two shots, no fall-out occurred at the pack stations selected. The results obtained from film packs exposed on Met and Apple II indicated that the maximum individual fall-out particle skin dose varied from >3000 rep beta at 7 miles from Ground Zero to 470 rep beta at the 140-mile arc. Tables are included which summarize the exposure conditions and results for all the film packs. (auth)

10179

PREPARATION OF NUCLEAR EMULSIONS CONTAINING MERCURY FOR STUDYING ITS PHOTODISINTEGRATION. J. Catala, J. Casanova, and F. Senent. Anal. real soc. espan, fis. y quim. (Madrid) Ser. A 53, 121-5(1957) May-June. (In Spanish)

Earlier glass capillary technique for nuclear emulsion loading has been improved. In this way the field of application has been increased, and the method for filling them with mercury is explained. An assay exposure of this plates to the bremsstrahlung has been made with good results. (auth)

10180

TEMPERATURE AND PRESSURE TIME CONSTANTS OF AN X-RAY DOSEMETER. W. S. B. Lowry (City of Dublin Skin and Cancer Hospital). Brit. J. Radiol. 30, 332(1957) June.

10181

ABSORBED DOSE NEAR BONE: A CONDUCTIVITY METHOD OF MEASUREMENT. John F. Fowler (King's Coll. Hospital, London). Brit. J. Radiol. 30, 361-6(1957) July.

10182

A LONGITUDINAL FIELD β SPECTROMETER WITH COMPENSATED SPHERICAL ABERRATION. K. A. Dolmatova and V. M. Kel'man (Physico-Technical Inst. Acad. of Sciences U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 113, 1244-7(1957) Apr. 21. (In Russian)

Descriptions are given of a longitudinal field β spectrometer whose spherical aberration is compensated by a transverse magnetic field with the intensity varying according to the law $H = H_1/r$. The coils of the compensation field were selected so that electrons escaping from the source at large angles formed a linear ring winding focus. (R.V.J.)

10183

COMPOUNDS OF CONSTANT LUMINESCENCE ACTIVATED BY β ISOTOPES. V. L. Levshin, E. P. Panasyuk, and L. A. Pakhomycheva (Lebedev Inst. of Physics). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 612-18(1957) Apr. (In Russian)

Isotopes of Sr^{90} and in some cases of Cs^{137} are recommended for preparations of compounds with constant luminescence. Compounds activated by Sr^{90} can be in practical use for 10 years and over. Maximum luminosity of green compounds with the Sr^{90} is about 10 times brighter than the luminosity of other compounds. Specimens of ZnS–Ag, ZnSCdS–Cu, and ZnS–Cu were used for the experiments. The organic glass and silicate glass with addition of CeO_2 in order of 1% are recommended as shielding coating materials. (R.V.J.)

10184

USE OF SCINTILLATION COUNTERS IN RADIOMETRIC APPARATUS FOR PROSPECTING RADIOACTIVE ORE DEPOSITS. A. L. Yakubov (All Union Inst. of Mineral Materials). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 636-40(1957) Apr. (In Russian)

10185

SPACE-CHARGE EFFECTS IN A PROPORTIONAL COUNTER. V. S. Venkatasubramanian (Indian Inst. of Science, Bangalore). J. Indian Inst. Sci. A & B 39, 125-8 (1957) Apr.

From the known characteristics of the space charge, an expression for the gas multiplication in a proportional counter is derived as a function of the primary ionization. The results are applied to the case of α and β particle pulses. (auth)

10186

DIBORANE-GAS FILLED COUNTING TUBES FOR MEASURING THERMIC NEUTRONS. O. J. Orient and E. I. Vizsolyi (Central Research Inst. for Physics, Budapest). Nuovo cimento (10) 5, 1722-8(1957) June.

A method for producing adequately pure diborane gas free from electron-negative impurities is described; the results of comparative research work on diborane-filled and boron-fluoride filled counting tubes are given. According to the results of measurements, the operating characteristics of the diborane-filled tubes coincide with those of the boron-fluoride filled tubes, the only difference being that the efficiency of the diborane-filled tubes is double of that of the boron-fluoride filled tubes. (auth)

10187

STEREOSCOPY IN BUBBLE CHAMBERS. P. Bassi, A. Loria, J. A. Meyer, P. Mittner, and I. Scotoni. Nuovo cimento (10) 5, 1729-38(1957) June.

Exact and approximate methods are given for the reconstruction of the position of a point in a bubble chamber, photographed with two cameras having parallel optic axes. In the appendix procedures are suggested for the direct reconstruction of a straight line and for the determination of the radius of curvature of a cylindrical helix with axis parallel to the optic axes. (auth)

10188

ACCURACY LIMITS IN THE MEASUREMENT OF TIME INTERVALS DEFINED BY SCINTILLATION COUNTER PULSES. S. Colombo, E. Gatti, and M. Pignanelli. Nuovo cimento (10) 5, 1739-62(1957) June.

Accuracy limits of the time of occurrence of an event detected by a scintillation counter are investigated. Two methods (nonlinear and linear) for extracting time information from the output current pulse of the photomultiplier are compared, taking into account statistics of photoelectron emission, transit time, and multiplication spread in the phototube and finite width of the response of the phototube to one photoelectron. Resolution obtained by the nonlinear method is better, but the linear method dispenses from an amplitude selection of pulses. (auth)

10189

INHIBITION OF SHRINKAGE IN NUCLEAR EMULSIONS. P. N. Krishnamoorthy (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci. 45, 327-35 (1957) May.

A method of inhibiting shrinkage in nuclear emulsions has been developed. It consists of replacing the silver halide in the emulsion, which is removed during the fixing stage of the processing by canada balsam. This method can be employed with advantage in the study of neutron spectra with nuclear emulsions, as it will yield improved energy resolution. Another field in which this process of shrinkage inhibition can be advantageously employed is the study of gamma ray spectra, with heavy water loaded emulsions. Here again, improved energy resolution is possible. In fact, this technique can be employed with advantage in all nuclear emulsion work, as it will result in overall reduction of distortion in emulsions, improve conditions for the measurement of tracks, and improve the stability and keeping qualities of processed emulsions. (auth)

10190

THE NEON FLASH TUBE AS A DETECTOR OF IONIZING PARTICLES. M. Gardener, S. Kisdnasamy, E. Rossle, and A. W. Wolfendale (Univ. of Durham). Proc. Phys. Soc. (London) B70, 687-99(1957) July.

A new type of particle detector developed recently by Conversi and his co-workers consists of a glass tube filled with neon which, after traversal by an ionizing particle, can be made to glow by the application of a strong electric field. Details are given of a systematic study of the flash tubes with a view to the production of a particle detector of high efficiency and low cost. It has been found that the requirements for high efficiency are not rigorous; relatively impure gas can be used, and time delays of several microseconds between the traversal of the particle and the application of the field can be tolerated. The limitations imposed by the presence of spurious flashes, i.e., flashes not associated with ionizing particles, are discussed. (auth)

10191

CURRENT SITUATION WITH REGARD TO PERMISSIBLE RADIATION EXPOSURE LEVELS. Lauriston S. Taylor (National Bureau of Standards, Washington). Radiology 69, 6-11(1957) July.

10192

BORON-LOADED LIQUID SCINTILLATION NEUTRON DETECTORS. Lowell M. Bollinger and George E. Thomas (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 28, 489-96(1957) July.

The general problems involved in constructing boron-loaded liquid scintillation neutron detectors are considered. The characteristics of particular counters which have been successfully used in neutron transmission measurements by the time-of-flight method are then described. The design of these counters was guided by the results of a Monte Carlo study of neutron capture in a boron-poisoned medium. This calculation gives the probability of neutron capture as a function of neutron energy, counter thickness, and time. The calculated results are compared with experimentally determined efficiencies. The advantages and problems encountered in using the boron-loaded liquid scintillator with the Argonne fast neutron chopper are discussed. (auth).

10193

DESIGNING FOR SAFETY IN HYDROGEN BUBBLE CHAMBERS. H. Paul Hernandez, John W. Mark, and Robert D. Watt (Univ. of California, Berkeley). Rev. Sci. Instr. 28, 528-35(1957) July.

The principal hazards of operating a liquid H_2 bubble chamber are failure of equipment (due to overpressure) and uncontrolled escape of H_2 gas, which may cause an explosion. If safety considerations are incorporated in planning from the job beginning, components can be designed to reduce or eliminate the probability of accidents arising from the known hazards. The degree of safety, the H_2 safety-vent system, and the hazards, and operation of the liquid H_2 bubble chambers at UCRL are discussed. (auth)

10194

RELATIVE MEASUREMENT OF RADIOACTIVE SUBSTANCES. Hans Houtermans. Strahlentherapie 103, 98-111(1957). (In German)

Techniques are presented for the detection of radioactive substances of interest as tracers in biological studies. The sensitivity of various methods is discussed. C.H.)

10195

APPLICATION OF THE SCINTILLATION SPECTROMETER IN PHYSICO-CHEMICAL STUDIES. N. G. Alekseev and V. P. Grigal, et al. Zhur. Fiz. Khim. 31, 915-19(1957) Apr. (In Russian)

Descriptions are given of the performance and design of a scintillation spectrometer with a single NaI crystal used for determination of the isotopic composition in γ emitter mixture. The calibration and measurement method permitting determination of the composition of the mixture with an accuracy of 5 to 10% is presented. (tr-auth)

Refer also to abstract 9974.

MESONS

10196 UCRL-3605

California. Univ., Berkeley. Radiation Lab.
INTERACTIONS AND LIFETIMES OF K MESONS (thesis). Edwin Laurence Iloff. Nov. 27, 1956. 49p. Contract W-7405-eng-48. $7.80(ph OTS); $3.30(mf OTS).

The lifetimes of K^+ (not including τ^+) and K^- mesons from the Bevatron have been measured by use of a nuclear emulsion technique. The values found are $\tau_{K^+} = 1.01 \pm^{0.33}_{0.21} \times 10^{-8}$ sec and $\tau_{K^-} = 0.95 \pm^{0.36}_{0.25} \times 10^{-8}$ sec. The equivalence of these lifetimes (within the statistical errors) supports the hypothesis that the K^+ and K^- mesons are charge conjugates of each other. A study of interactions in flight of K^- mesons has yielded a mean free path in nuclear emulsion of $\lambda_{K^-} = 23 \pm^{6}_{5}$ cm, which is consistent with a geometric cross section. The products of the 21 interactions in flight observed include charged π mesons, charged Σ hyperons, and an excited fragment. No inelastically scattered K^- mesons were found. All the interactions were consistent with the conservation of strangeness. Elastic scattering of K^- mesons is discussed. The interactions of K^- mesons at rest in nuclear emulsion are discussed in the light of the data thus far published. From the π-meson and the Σ-hyperon energy spectra it is concluded that nearly all the interactions may be accounted for by single-nucleon capture of K^- mesons by the processes allowed by the conservation of strangeness, and that most of these primary reactions yield Σ hyperons rather than Λ^0 hyperons. A small percentage of the interactions may be due to capture by two nucleons. It is shown that if charge independence is assumed, the frequencies of charged π mesons and charged Σ hyperons are accounted for, and that in the cases in which Σ hyperons are produced the T = 1 isotopic spin state contributes appreciably though it is not necessarily dominant. (auth)

10197 UCRL-3784

California. Univ., Berkeley. Radiation Lab.
INTERACTIONS OF NEGATIVE K MESONS IN FLIGHT IN NUCLEAR EMULSION (thesis). Frank Hunter Featherston. Apr. 30, 1957. 39p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

Submitted to the United States Naval Postgraduate School, Monterey, Calif.

A survey of interactions of K^- mesons in flight in nuclear emulsion has been made. Seventy-seven in-flight interactions, seven decays in flight, and four inelastic scatterings were found. A K^- meson mean free path in nuclear emulsion of 30.0 ± 3.0 cm and a lifetime of $1.31^{+0.38}_{-0.28} \times 10^{-8}$ sec have been calculated. All interactions were consistent with the conservation of strangeness. A general qualitative comparison is made between the in-flight and at-rest interactions of K^- mesons. Two decays in flight were measured, one leading to a definite establishment of a $K^-_{\tau_2}$ decay mode, the other to a strong suggestion of a $K^-_{\mu 2}$ mode. The angular distribution of the decay pions from 37 Σ hyperons produced by K^- interactions is reported. The distribution tends towards isotropy. (auth)

10198

ON THE POSSIBLE DIPOLE MOMENT OF TRANSITION FOR Λ PARTICLES. B. L. Ioffe and I. Ya. Pomeranchuk. Doklady. Akad. Nauk S.S.S.R. 113, 1251-4(1957) Apr. 21. (In Russian)

The scattering of Λ particles by the nuclear Coulomb field and the appearance of levels in the nuclear Coulomb field observed in the Λ particle dipole moment were analyzed. (R.V.J.)

10199

DISPERSION RELATIONS FOR THE DECAY OF THE τ-MESON. E. Corinaldesi (Univ. of Glasgow). Nuclear Phys. 3, 649-55(1957) July.

The kinematics of the τ-meson decay is formulated so as to make possible the use of dispersion relations for the transition amplitude. (auth)

10200

A THEORETICAL ESTIMATE OF THE INFLUENCE OF THE CHARACTER OF THE FOUR-FERMION INTERACTION ON THE MUON CAPTURE RATE. H. A. Tolhoek and J. R. Luyten (Univ. of Leyden). Nuclear Phys. 3, 679-88(1957) July.

The four fermion interaction for muon capture may contain the Fermi interaction as well as the Gamow-Teller interaction, similar to the situation for the beta radioactivity. Theoretical calculations of the muon capture rate were made for both types of interaction for the nuclei from Ca to Ni, assuming nuclear shell structure. It follows that an experimental determination of the ratio of Fermi to Gamow-Teller interaction should be feasible by measuring the ratio of muon capture rates in suitably chosen nuclei (preferably the separated isotopes, although the use of the natural isotope mixtures is not quite excluded). The ratio of the capture rates for two nuclei differs often up to 50% for Fermi and Gamow-Teller interaction. As several simplifying assumptions were made, the results of the calculations may have more qualitative than quantitative significance; however, the results obtained seem to justify further theoretical and experimental work on the subject. The published experimental data do not allow to draw any conclusions with certainty, but may contain an indication for preponderant Gamow-Teller interaction. (auth)

10201

EXAMPLES OF THE PRODUCTION OF $(K^0,\bar{K}^0)$ AND $K^+,K^0)$ PAIRS OF HEAVY MESONS. W. A. Cooper, H. Filthuth, J. A. Newth, G. Petrucci, R. A. Salmeron, and A. Zichichi (C.E.R.N., Geneva). Nuovo cimento (10) 5, 1388-97(1957) June.

Two simple nuclear interactions that produce pairs of K mesons are described and discussed. They are interpreted as examples of the processes $n + p \rightarrow K^0 + \bar{K}^0 + n + p$ and $n + p \rightarrow K^+ + \bar{K}^0 + n + n$ where $\bar{K}^0$ is the antiparticle of the K^0 meson. (auth)

10202

MESON PRODUCTION BY A MESON NUCLEON COLLISION IN THE HEISENBERG REPRESENTATION. G. R. Screaton (Emmanuel Coll., Cambridge). Nuovo cimento (10) 5, 1398-1410(1957) June.

A relation between the interaction operator, the Heisenberg operator, and the interaction Hamiltonian is established. The matrix element for the production of mesons by a meson-nucleon collision is obtained with all its renormalization terms. A causality condition is shown to be involved in this matrix element. (auth)

10203

ON THE VISCOUS FLUID MODEL IN MULTIPLE PRODUCTION OF MESONS. M. Hamaguchi (Kyoto Univ., Japan). Nuovo cimento (10) 5, 1622-35(1957) June.

The viscous effects in the hydrodynamical description of multiple production of particles in high-energy collisions are discussed quantitatively. The multiplicity of the particles and the angular distribution (mean plateau) in the laboratory frame of reference are numerically calculated, and these results are compared with those obtained by Rozental et al. It is also shown that the viscous coefficients can be roughly estimated by the comparison with experimental data. (auth)

10204

ON THE ANGULAR CORRELATION IN THE β-DECAY OF μ-MESONS OBSERVED IN PHOTOGRAPHIC EMULSION.

B. Bhowmik, D. Evans, and D. J. Prowse (Univ. of Bristol). Nuovo cimento (10) 5, 1663-9(1957) June.

The anisotropy of the distribution in the angle θ between the direction of emission of the positron and that of the μ meson has been measured in stripped emulsion stacks exposed to the cosmic radiation. Assuming a distribution of the form $(1 + a \cos \theta)$ a value of $-.081 \pm .05$ has been obtained for "a". This result is compared with those obtained by other workers, and the depolarizing effects of photographic emulsion are discussed. (auth)

10205

PARITY VIOLATION AND THE SPIN OF THE Λ^0 PARTICLE. F. Cerulus (CERN, Geneva). Nuovo cimento (10) 5, 1685-92(1957) June.

The ratio of nonmesonic to mesonic decay is calculated using a phenomenological hamiltonian for the Λ decay interaction and for the pion-nucleon interaction. In the calculation the absorption by the nucleons of charged and neutral virtual pions from the Λ is taken into account, and parity conservation in the Λ decay is not assumed. If parity were strongly violated, a comparison of the results of the calculation with experiment would indicate that the Λ has spin $\frac{1}{2}$. If the parity violation is slight, spin $\frac{3}{2}$ is still possible. The value of the ratio of nonmesonic to mesonic decay is calculated numerically for He^4_Λ, H^4_Λ, and Be^9_Λ under different assumptions about spin and parity. (auth)

10206

SYSTEMATICS OF Λ^0 AND θ^0 DECAY. F. Eisler, R. Plano, and N. Samios (Columbia Univ., New York) and M. Schwartz and J. Steinberger (Brookhaven National Lab., Upton, N. Y.). Nuovo cimento (10) 5, 1700-15(1957) June.

10207

INTERACTIONS OF μ-MESONS UNDERGROUND (190 Mev). S. Naranan, P. V. Ramanamurty, A. B. Sahiar, and B. V. Sreekantan (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10) 5, 1773-6(1957) June.

10208

EMISSION OF AN ELECTRON PAIR IN A K^+-DECAY. R. Levi-Setti and W. Slater (Univ. of Chicago, Ill.). Nuovo cimento (10) 5, 1784-6(1957) June.

10209

A DISCUSSION OF THE POSSIBILITY OF DETECTING ASYMMETRIES IN THE Λ^0 DECAY. G. Morpurgo. Nuovo cimento (10) 5, 1787-9(1957) June.

10210

ON PARITY NON-CONSERVATION IN THE DECAY OF STRANGE PARTICLES. N. Dallaporta and F. Ferrari. Nuovo cimento (10) 5, 1793-6(1957) June.

10211

NUCLEAR INTERACTIONS OF LONG-LIVED NEUTRAL STRANGE PARTICLES. R. Ammar, J. I. Friedman, R. Levi Setti, and V. L. Telegdi (Univ. of Chicago, Ill.). Nuovo cimento (10) 5, 1801-7(1957) June.

10212

ON THE ANGULAR CORRELATION IN μ-e DECAYS OBSERVED IN NUCLEAR EMULSIONS EXPOSED IN MAGNETIC FIELD. J. Heughebaert, M. René, J. Sacton, and G. Vanderhaeghe. Nuovo cimento (10) 5, 1808(1957) June.

10213

FUSION INDUCED BY Mu-MESONS. T. H. R. Skyrme (Atomic Energy Research Establishment, Harwell, Didcot, Berks). Phil. Mag. (8) 2, 910-16(1957) July.

An experiment has recently been reported from which it has been inferred that the (p,d) reaction is catalyzed by the presence of mu mesons forming mesic atoms and molecules. A brief analysis is made in this note of the reaction rates necessary to explain the experimental results. The relatively large number of events observed in which the meson takes away the energy released in the reaction can be understood as the result of conversion of an electric monopole transition. (auth)

10214

CASCADE DECAY OF A HEAVY K-MESON. S. N. Sen Gupta and M. S. Sinha (Bose Inst., Calcutta). Phil. Mag. (8) 2, 936-8(1957) July.

Cloud chamber evidence for cascade decay of a heavy charged unstable particle is reported. Two V-events are shown, one due to a charged particle and the other due to a neutral particle. From a consideration of the coplanarity of the apex of the charged V-event and the tracks of the two secondaries of the other and also of the angles of emission and minimum ionization of all the decay products, it appears that a particle of mass not below $146m_e$ has undergone a cascade decay process according to the mode $K^\pm \rightarrow L^\pm + \theta \rightarrow \pi^+ + \pi^- + 212$ Mev. (M.H.R.)

10215

NUCLEAR EMULSION EVIDENCE FOR PARITY NONCONSERVATION IN THE DECAY CHAIN $\pi^+ \rightarrow \mu^+ \rightarrow e^+$. Jerome I. Friedman and V. L. Telegdi (Univ. of Chicago, Ill.). Phys. Rev. 106, 1290-3(1957) June 15.

Following a suggestion of Lee and Yang, the correlation between the initial direction of motion of the muon and the direction of emission of the positron in the decay chain $\pi^+ \rightarrow \mu^+ \rightarrow e^+$ was investigated in nuclear emulsion to detect a possible parity nonconservation in both decay interactions. Positive pions from the University of Chicago synchrocyclotron were brought to rest in emulsion carefully shielded from magnetic fields, and 2000 complete decay events were measured. A correlation $W(\theta) = 1 + a \cos\theta$ was found, with $a = -0.174 \pm 0.038$, clearly indicating a backward-forward asymmetry, i.e., a violation of parity conservation in both decay processes. Actually, following an argument of Lee, Oehme, and Yang, this asymmetry implies a noninvariance of either interaction with respect to both space inversion and charge conjugation, taken separately. A detailed discussion of a depolarization process specific to μ^+ mesons, i.e., the possible formation of "muonium," (μ^+e^-), is given. The results of this and similar experiments are compared with those obtained with muons originating from π^+ decays in flight, and the implications of such a comparison are discussed. (auth)

10216

INFORMATION OBTAINABLE ON POLARIZATION OF μ^+ AND ASYMMETRY OF e^+ IN MUONIUM EXPERIMENTS. G. Breit and V. W. Hughes (Yale Univ., New Haven, Conn.). Phys. Rev. 106, 1293-5(1957) June 15.

The formation of the compound $\mu^+ + e^-$ (muonium) is considered as a tool for gaining information regarding the polarization of the μ^+ before their capture by the e^- and the asymmetry of e^+ emission in the disintegration $\mu^+ \rightarrow e^+ + \nu + \nu'$. The detection of asymmetry effects is supposed to take place through the counting of e^+. The effect of constant magnetic fields and of microwave-induced transitions among magnetic substates of muonium is calculated, with the conclusion that all of the experiments considered here determine in different ways the same combination of parameters describing the initial muon polarization and the asymmetry of e^+ emission in muon decay. (auth)

10217

MODEL OF THE STRONG COUPLINGS. Murray Gell-Mann (California Inst. of Tech., Pasadena). Phys. Rev. 106, 1296-1300(1957) June 15.

An attempt is made to construct a crude field theory of

hyperons and K particles, which are assumed to have spin ½ and spin 0, respectively. The parity of Λ is defined to be plus. Some preliminary experimental evidence is adduced in support of parity plus for Σ. It is further argued that Λ and Σ are coupled to π with roughly the same coupling constant as in the π−N case, while the coupling of K to baryons is weaker. A model of the strong couplings is suggested that incorporates these features. The very strong (VS) pion interactions are completely symmetrical in the baryons, and would leave them all degenerate in the absence of the moderately strong (MS) interactions of K. These last lead to the mass differences among baryons and to the production and absorption of K particles. The MS coupling constants must be determined by experiment, but the VS interactions are exactly specified. With the MS couplings treated in lowest approximation, it is possible to relate any matrix element for K and hyperon reactions to a corresponding matrix element in the theory of nucleons and pions. Thus in the processes $\overline{K} + p \rightarrow \pi + \Lambda$ and $\overline{K} + p \rightarrow \pi + \Sigma$ it is expected that in the final state the analog of the (3/2,3/2) resonance of the π−N system will be observed. It may be, as Wigner has suggested, that the equality of pion couplings for the baryons is somehow related to the conservation of baryons, and that the analogy with electromagnetic coupling is instructive. (auth)

10218

CHIRALITY OF K PARTICLE. Satosi Watanabe (International Business Machines, Poughkeepsie, N. Y.). Phys. Rev. 106, 1306-15(1957) June 15.

In the two-component theory, the neutrino that can exist in nature is characterized by one of the eigenvalues of the chirality operator, γ_5, which anticommutes with the parity operator. The chirality operator is generalized so that it can be applied also to bosons. The K particle that can exist in nature is characterized by a certain condition on the eigenvalues of the chirality operator. There is strong reason to believe that the chirality quantum number thus introduced is closely related to the strangeness quantum number. (auth)

10219

APPLICATION OF DISPERSION RELATIONS TO LOW-ENERGY MESON-NUCLEON SCATTERING. G. F. Chew (Univ. of Illinois, Urbana and Inst. for Advanced Study, Princeton, N. J.), M. L. Goldberger and Y. Nambu (Univ. of Chicago, Ill.) and F. E. Low (Univ. of Illinois, Urbana and Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 106, 1337-44(1957) June 15.

Relativistic dispersion relations are used to derive equations for low-energy S-, P-, and D-wave meson-nucleon scattering under the assumption that the (3,3) resonance dominates the dispersion integrals. The P-wave equations so obtained differ only slightly from those of the static fixed-source theory. The conclusions of the static theory are re-examined in the light of their new derivation. (auth)

10220

RELATIVISTIC DISPERSION RELATION APPROACH TO PHOTOMESON PRODUCTION. G. F. Chew (Univ. of Illinois, Urbana and Inst. for Advanced Study, Princeton, N. J.), M. L. Goldberger and Y. Nambu (Univ. of Chicago, Ill.), and F. E. Low (Univ. of Illinois, Urbana and Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 106, 1345-55(1957) June 15.

Relativistic dispersion relations for photomeson production, analogous to the pion-nucleon scattering dispersion relations, are formulated without proof. The assumption that the 33 resonance dominates the dispersion integrals then leads to detailed predictions about the photomeson amplitude. An attempt is made to keep first order (in v/c) nucleon recoil effects. Except for the latter, the predictions of the cutoff model are generally reproduced. (auth)

10221

POSSIBLE EXISTENCE OF A HEAVY NEUTRAL MESON. Yoichiro Nambu (Univ. of Chicago, Ill.). Phys. Rev. 106, 1366-7(1957) June 15.

The possibility of a heavy neutral meson which can contribute to the form factor of the nucleon was considered in an attempt to account for the charge distribution of the proton and neutron as indicated by the electron scattering experiments. Assuming that this meson is a vector field with isotopic spin zero and a mass two to three times that of an ordinary pion, coupled strongly to the nucleon field, the consequences of these assumptions are discussed. (M.H.R.)

10222

POSSIBLE DETECTION OF PARITY NONCONSERVATION IN HYPERON DECAY. T. D. Lee and J. Steinberger (Columbia Univ., New York) and G. Feinberg, P. K. Kabir, and C. N. Yang (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 106, 1367-9(1957) June 15.

A phenomenological study is made of the problem of possible detection of parity nonconservation in hyperon decay under the assumption that there exist no parity doublets for either K mesons or hyperons. It is concluded that any appreciable asymmetry in the distribution function $W(\theta,\xi)$ with respect to the sign of ξ is an indication that conservation of parity and invariance under charge conjugation do not hold in the decay of Σ^- or Λ^0. (M.H.R.)

10223

EXPERIMENTS WITH A POLARIZED MUON BEAM. J. M. Cassels, T. W. O'Keeffe, M. Rigby, A. M. Wetherrell, and J. R. Wormald (Univ. of Liverpool). (Proc. Phys. Soc. (London) A70, 543-6(1957) July.

The apparatus used to observe muons coming from pions decaying near their point of production at a Be target inside the cyclotron is diagramed. Results indicate the beam is longitudinally polarized and the g value is 2.004 ± 0.014. The time distribution of forward electrons from positive muons stopped in Cu and C is graphed. (M.H.R.)

10224

PARITY MIXING EFFECTS IN τ-θ DECAY. S. B. Treiman and H. W. Wyld, Jr. (Princeton Univ., N. J.). Phys. Rev. 106, 1320-3(1957) June 15.

The recent results on nonconservation of parity in decay processes involving neutrinos do not provide an unambiguous solution of the τ-θ puzzle. In fact the 2π and 3π decay modes of θ and τ involve no neutrinos, whereas the Lee-Yang two-component neutrino theory attributes the nonconservation of parity to special properties of the neutrino. However, even if the τ and θ are different particles with opposite parities, the neutrino decay modes (μ,ν), (e,π,ν), and (μ,π,ν), which presumably violate parity conservation, will cause mixing of the two particles τ and θ — in the sense that the states with definite lifetimes will be certain linear combinations, K_1 and K_2, of τ and θ. Both K_1 and K_2 will then decay into both 2π and 3π as well as the neutrino modes, but with different lifetimes. An explanation of the apparent equality of lifetimes of τ and θ may be that under present experimental conditions only the long-lived component K_2 is observed. If this is the case, interference effects between the K_1 and K_2 components should be found in experiments performed at shorter times. Conversely, absence of such effects would constitute strong evidence that τ and θ are identical. Phenomenological expressions are derived by the Wigner-Weisskopf method for the decay rates, including interference effects; and various experimental possibilities are discussed. (auth)

MOLECULAR PROPERTIES

10225 CR-MET-702

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

SELF DIFFUSION IN POLYCRYSTALLINE PLATINUM. G. V. Kidson and R. Ross. May 1957. 23p. (AECL-449).

Self diffusion coefficients of pure Pt have been determined between 1325 and 1600°C using the radioactive isotope Pt^{195m}. The results can be expressed by the equation $D = 0.33 \exp(-2.96/kT)$. The value of the activation energy does not agree with that predicted by quenching experiments. (auth)

10226 NP-6336

Cincinnati. Univ. Research Foundation.

MOLECULAR ORBITAL CALCULATIONS USING AN IBM 650 MDDPM. Technical Report No. 3. Hans H. Jaffe. 110p. DA Project No. 5B99-01-004. Contract DA-33-008-ORD-1155.

10227

CONTRIBUTION OF π-ELECTRONS TO NUCLEAR SPIN-SPIN COUPLING OF AROMATIC PROTONS. Harden M. McConnell (California Inst. of Tech., Pasadena). J. Molecular Spectroscopy 1, 11-17(1957) July.

Empirical data on hyperfine splittings in aromatic free radicals are used as a basis for estimating the contribution of π-electrons to proton-proton nuclear spin-spin couplings in aromatic molecules. This contribution of the π-electrons to the coupling of protons N and N' is $J_{NN'}{}^{\pi} = \beta^2 Q^2 \eta_{NN'}{}^{\pi} / h\Delta E$, where β is the Bohr magneton, Q is a hyperfine splitting constant with an empirical value of 30 ± 3 gauss, $\eta_{NN'}$ is the bond-border connecting carbon atoms N and N', and ΔE is an effective electronic excitation energy. Estimates indicate that $J_{NN'}{}^{\pi}$ is quite small for one or two-ring aromatic systems, i.e., $\lesssim 1$ cps. This contribution to proton-proton splittings, though small, does have the interesting property that it is not rapidly attenuated with increasing bond distance between proton pairs. (auth)

NEUTRONS

10228 AERE-RP/R-1393

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

STUDIES ON THE DIFFUSION OF FISSION NEUTRONS THROUGH URANIUM. R. M. Absalom, J. E. R. Holms, M. U. Lea, and L. R. Shepherd. Mar. 1954. 21p.

The diffusion of neutrons from a fission source through a large mass of uranium has been investigated. A diffusion length, based on an assumption of spherical symmetry and applying a one group theory, was deduced from measurements made with a Pu fission chamber. This had a value of 12 cms. Neutrons with energies greater than 1 Mev were observed to diffuse with a much shorter relaxation length, 7.2 cms. Effective cross sections for fission of U^{235} and capture of U^{238} and Au^{197} were deduced, using the Pu^{239} fission cross section (assumed to be 1.94 b.) as a standard. The variation of these cross sections with distance from the source was studied. Measurements were made on the energy spectra of the neutron fluxes at different distances from the source, using the photographic plate technique (recoil protons) for energies above 1 Mev, and proportional counters filled with nitrogen (n-p reaction) and hydrogen (recoil protons) for lower energies. The variations in cross sections and energy spectrum with distance from the source were found to be consistent. (auth)

10229 ORNL-2309

Oak Ridge National Lab., Tenn.

CONFERENCE ON NEUTRON PHYSICS BY TIME-OF-FLIGHT HELD AT GATLINBURG, TENNESSEE, NOVEMBER 1 AND 2, 1956. R. C. Block, W. M. Good, J. A. Harvey, H. W. Schmitt, and G. T. Trammell, eds. July 1, 1957. 207p. Contract W-7405-eng-26. $1.00(OTS).

Discussions are included on nuclear size by potential-scattering cross sections and gamma radiation from resonance neutron capture in Hg. Results of studies of Nevis neutron time-of-flight data from U^{238} and Ag are given. Neutron resonance parameters of Eu^{151}, Eu^{153}, Na, and Ag are included. Total neutron cross sections of uranium isotopes were studied and experimental results compared with various nuclear model predictions. Experimental and theoretical cross sections are compared for S, Cd, and Mn. Inelastic scattering data were given for Rh, Nb, Au, Zr^{94}, and Pt^{194}. Elastic scattering data for Bi, Zr, Fe, and C are analyzed. The total cross sections of the major isotopes of Pu, Pt, and a series of rare-earth elements have been studied to determine the fluctuations in average values. The spectra of neutrons from $Li^7(p,n)Be^7$ below threshold and at 18, 19, and 40 kev above threshold were graphed. Total neutron cross sections of Bi, Pb, Y, Ti, Se, Ni^{58}, Ni^{60}, S, Al, and Fe are graphed as a function of energy. Fission cross sections and other neutron data for Pu^{239}, Pu^{240}, U^{233}, and U^{235} are given. The velocities of coincident pairs of fragments in the spontaneous fission of Cf^{252} are included. (M.H.R.)

10230

THE PRODUCTION OF INTENSE COLD NEUTRON BEAMS. I. Butterworth, P. A. Egelstaff, H. London, and F. J. Webb (Atomic Energy Research Establishment, Harwell). Phil. Mag. (8) 2, 917-27(1957) July.

The moderation of pile neutrons to very low energies has been investigated. Liquid H_2, liquid HD and CH_4 at 20°K were found to be effective moderators. After an examination of the safety aspects, a volume of liquid H_2 was maintained at the center of a reactor, and the velocity spectrum of neutrons scattered from it was measured. Appreciable moderation of neutrons to very low energies was observed. By this method it is practicable to increase considerably the flux of cold neutrons in a beam. Thus, in the present experiment the flux of 10 Å wavelength was increased by a factor of 25. (auth)

NUCLEAR PHYSICS

10231 ANL-5698

Argonne National Lab., Lemont, Ill.

PHYSICS DIVISION SUMMARY REPORT [FOR] JANUARY THROUGH MARCH, 1957. Apr. 1957. 85p. Contract W-31-109-eng-38. $0.50(OTS).

A method of measuring fission cross sections is described which avoids the uncertainties of foil thickness, neutron energies, and the value of a reference absorption cross section. Five neutron groups, corresponding to excited states in Fe^{55}, were observed from the reaction $Mn^{55}(p,n)Fe^{55}$. The study of gamma rays produced by radiative capture of alpha particles was continued with a search for resonances and energies in the reaction $Li^6(\alpha,\gamma)B^{10}$. Methods used in observing a 5.6 sec delayed neutron emission from U^{235} fission product I^{138} are described. The 24 sec delayed neutron emission from I^{137} was also observed. Additional differential elastic scattering cross sections for 14-Mev neutrons are reported. Observed beta decay interactions from polarized Li^8 nuclei failed to satisfy assumed requirements of parity and conservation.

The experimental methods used in these observations are presented and the results are interpreted. Experiments are discussed which indicate the dependence of photomultiplier tube response on scintillator emission spectra. The relative scintillation efficiencies of 26 air-saturated toluene solutions were determined for uniform excitation conditions. The kinetic energy distributions of ions from the dissociation of CH_4 and CH_3Br under electron impact were plotted. (For preceding period see ANL-5667.) (D.E.B.)

10232 CU-154

Columbia Univ., New York. Nuclear Physics Labs. PROGRESS REPORT FOR JULY, AUGUST, SEPTEMBER 1956 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. Dept. of Physics. 77p. Contract AT 30-1-GEN-72. $12.30(ph OTS); $4.50(mf OTS).

Results are presented on energy level measurements of Ag and U^{238} from 250 to 600 ev and Ta from 130 to 250 ev, using the Nevis neutron velocity spectrometer. A sample of zinc was run to study the levels at 225, 455, and 530 ev in which the principal process is scattering. Although the levels could be detected, the application of the (n,γ) technique to this type of level was not found to be very promising. The Columbia neutron crystal spectrometer has been calibrated using the Bragg cut-off in Si. The 2200 m/sec value of the capture cross section of Au is 98.8 ± 0.3b. Additional measurements have been made in metallic hydrides (Zr, Ti, Pd) in the long neutron wavelength region to study the binding of H in various substances. The states in O^{16} below 12 Mev which decay by γ emission have been studied and results compared with the α-particle model of the nucleus. A search for electric monopole pairs from the 3.82 Mev state of Ca^{48} shows no strong pair line. Gamma-ray and electric monopole pair transitions in C^{12} up to 10.4 Mev has been investigated. The threshold of the $N^{15}(p,n)O^{15}$ reaction was found to be 3.779 ± 0.007 Mev and an absolute cross section was determined at 0 and 90° for E_p varying from 4.21 to 4.66 Mev. Theoretical studies of the shell, optical, and cloudy crystal ball models are in progress. The decay of K^{43} was reinvestigated in order to explain certain discrepancies which exist in the results on the isobars. The scintillation pulse height and resolution of Po^{210} α particles in He, A, Kr, Xe, and N_2, and various mixtures of these gases, have been investigated and results are given. The use of a gas scintillation counter to study the $B^{10}(n,\alpha)$ reaction and, the fission of U^{235} was investigated. The spectral distribution of light emitted when charged particles pass through He was investigated as a function of impurities and pressure. The resolution of the system was increased and results obtained on He and A. The determination of the end point of the O^{15} positron spectrum has been further improved to give a final value of 1.736 ± 0.010 Mev. (For preceding period see CU-153.) (M.H.R.)

10233 UCRL-3782

California. Univ., Berkeley. Radiation Lab. PHYSICS DIVISION QUARTERLY REPORT [FOR] FEBRUARY, MARCH, APRIL 1957. May 13, 1957. 57p. Contract W-7405-eng-48. $0.40(OTS).

Results of measurements on nuclear reactions catalyzed by μ mesons are tabulated. Preliminary data on a study of K-mesic x rays were included. Several graphs of cross sections, angular distributions, scattering data, etc. of K^+ meson interactions in nuclear emulsion are given. Information on K^- mesons interactions in flight and at rest is reported. Data on antiproton collision cross sections and antineutron production by charge exchange are included. (For preceding period see UCRL-3689.)

10234

A GENERALIZATION OF THE DIRAC EQUATION FOR SLOW FERMIONS. Parviz Merat. Compt. rend. 244, 3131-3(1957) June 24. (In French)

Beginning with squared matrices with eight dimensions, the Dirac theory was generalized to include an isotopic space-time with four dimensions which has for its fourth dimension the ordinary time, and for its other dimensions, three distinct dimensions of ordinary space-time. A generalization of the transformation of matter and of the law of conservation was obtained. (tr-auth)

10235

EQUIVALENCE OF TENSOR AND SPINOR DESCRIPTIONS OF PARTICLES OF SPIN ½. Alix Aymard. Compt. rend. 244, 3133-6(1957) June 24. (In French)

The equivalence is shown in euclidean space-time of the two descriptions in giving expressions which permit passing from one to the other. A criticism is made of the generalization of the relation $W = h\nu$. (tr-auth)

10236

THE INTERACTION OF β DISINTEGRATIONS WHICH DO NOT CONSERVE PARITY. Roger Nataf. Compt. rend. 244, 3144-7(1957) June 24. (In French)

Previously, granting the principle of invariance by reversal of time, some relations were deduced which implied a constant direction for the longitudinal polarization of β^- and β^+. More recent experiments seem to indicate that it depends on the nature of the transition, leading to abandonment of the principle of invariance by reversal of time. (tr-auth)

10237

THE NUCLEAR PARAMAGNETIC RESONANCE OF PROTONS IN SOLID CYCLOHEXANOL AS A FUNCTION OF TEMPERATURE. Mierre Averbuch. Compt. rend. 244, 3147-50(1957) June 24. (In French)

At temperatures below -96°C the progressive liberation of a rotation movement of molecules two by two around a common axis was observed. Then at -70°C a rotation of the molecules around their center of gravity appeared, all of the orientations being permitted. Finally, in the "high temperature" phase, a diffusion movement of molecules within the crystal was distinguished. (tr-auth)

10238

FURTHER RESULTS ON ANTIPROTON ANNIHILATIONS. E. Amaldi, C. Castagnoli, M. Ferro-Luzzi, C. Franzinetti, and A. Manfredini. Nuovo cimento (10) 5, 1797-1800(1957) June.

A stack of 140 pellicles was exposed to a flux of antiprotons. In this stack 14 events were found which may be interpreted as due to antiprotons: of these events, 4 annihilate at rest; 5 annihilate in flight, releasing a visible energy larger than their kinetic energy; 5 produce a star having a visible energy smaller than their kinetic energy. Interpretations of the events are discussed. (L.T.W.)

10239

DIFFRACTIONAL SCATTERING OF FAST DEUTERONS BY NUCLEI. A. I. Akhieser and A. G. Sitenko (Kharkov Univ., U.S.S.R.). Phys. Rev. 106, 1236-46(1957) June 15.

The elastic scattering cross section σ_e and the diffractional disintegration cross section σ_d for fast deuterons incident on absolutely black nuclei are determined, and the energy spectrum of the disintegration products is found. For $R \gg R_d \gg \lambda\!\!\!^{-}$ [where R and R_d are the radii of the nucleus and of the deuteron, respectively, and $\lambda\!\!\!^{-}$ is $(2\pi)^{-1}$ times the wavelength of the deuteron], the cross sections are $\sigma_e = \pi R^2 + \frac{2}{3}\pi(1-\ln 2)RR_d$ and $\sigma_d = \frac{1}{3}\pi(2\ln 2 - \frac{1}{2})RR_d$. The total cross section for all processes (including the stripping and the absorption of the deuteron) is $\sigma_t = 2\pi R^2 +$

πRR_d. The disintegration cross section for fast deuterons, taking into account the diffraction and the Coulomb interaction, is found. If the nucleus is absolutely black and if $R \gg R_d$, there is no interference between the diffractional disintegration and the disintegration due to the Coulomb interaction. If in this case $n = Ze^2/\hbar v \ll 1$ (where v is the velocity of the deuteron), the disintegration cross section due to the Coulomb interaction is a small correction to the diffractional disintegration cross section. If $n \gg 1$ and $E \gg B$ (where E is the energy of the deuteron and B is the height of the Coulomb barrier), the disintegration cross section can also be found; in this case it is determined mainly by the Coulomb interaction and is $\sigma_f = (4\pi/3)n^2R_d^2 \ln(R_d/\lambda\!\!\!^{-})$. Expressions are found for the elastic scattering cross section for a deuteron, taking into account the semitransparence of the nuclei. (auth)

10240

EXTERNAL COULOMB FIELDS IN THE WIGNER-EISENBUD NUCLEAR REACTION THEORY. G. Breit and J. S. McIntosh (Yale Univ., New Haven, Conn.). Phys. Rev. 106, 1246-8(1957) June 15.

The Wigner-Eisenbud $\mathcal{R}$ matrix treatment of nuclear reaction theory is generalized to allow for Coulomb interactions in the channels and pertinent explicit relations are given. (auth)

10241

ROLE OF STRONG INTERACTIONS IN DECAY PROCESSES. Steven Weinberg (Princeton Univ., N. J.). Phys. Rev. 106, 1301-6(1957) June 15.

An attack is made on the problem of determining which are the primary interactions that contribute to decay processes. It is necessary first to understand the role of the strong interactions in these processes; this has proven difficult in the past because of the appearance of infinities. It is shown that all infinities appearing in decay processes involving nucleons, pions, photons, and one lepton pair may be removed by renormalization to all orders in the strong and electromagnetic coupling constants. The necessary and sufficient condition for renormalizability is that the primary interactions that actually exist in nature form one of certain subclasses of a class of fourteen possible primary interactions. In particular, from this point of view it is incorrect to treat the π-meson decay as proceeding via Fermi interactions only. Two incidental results of this work are that the use of perturbation theory in computing the contribution of the pion decay interaction to μ-meson absorption is justified, and that the principle of minimal electromagnetic coupling is violated in the radiative tensor decay of the π meson. (auth)

10442

PREDICTION OF DELAYED-NEUTRON PRECURSORS. G. R. Keepin (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 106, 1359-60(1957) June 15.

Individual precursor yields for the six fissionable nuclides have been calculated from the appropriate mass and charge distributions, including shell effects. Comparison of precursor yields thus calculated with measured delayed-neutron yields for the various nuclides then gives neutron-to-β branching ratios which may be related to theoretical branching ratios. This treatment provides criteria for selecting the most probable precursors associated with a given delayed-neutron group. The predictions resulting from preliminary calculations are summarized. (M.H.R.)

10243

COMPOUND NUCLEAR THEORY AND THE OPTICAL MODEL. J. Bowcock (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London) A70, 515-28(1957) July.

A formalism is developed to relate the total cross section for low-energy nucleon-nucleus scattering to the cross section due to a potential well. By introducing the intermediate model of Lane, Thomas, and Wigner for the compound nucleus states, a simple relation between these two cross sections is obtained. The method of extracting a potential well to replace the hard sphere scattering and the scattering from far distant levels is given and then extended to find the well which describes the average total cross section. (auth)

NUCLEAR PROPERTIES

10244 AERE-NP/R-2076(Rev.)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

PROCEEDINGS OF THE TRIPARTITE CONFERENCE ON CROSS-SECTIONS OF FISSILE NUCLEI. N. J. Pattenden, ed. [July] 1956. 154p. (TNCC(UK)-9).

New results are presented on the total, absolute, and fission cross sections of Pu isotopes, fission cross sections of U^{233} and U^{235} and the absolute cross sections of U^{233}. Fission width distributions for U^{233} and U^{235} and neutron detection methods from 20 to 100 kev are described. New results on α, η, and ν for energies less than 10^4 ev and new methods for the determination of resonance parameters and handling of data are given. Some aspects of fission theory are discussed. Discussions are included on the capture cross sections (σ_c) of U^{238} and Th^{232}, techniques for σ_c measurements, flux measurements between 2 and 25 Mev, and integral measurements in Harwell's fast reactor. Van de Graaff time of flight measurements and angular distributions and inelastic scattering measuring with He^3 spectrometers are presented. (M.H.R.)

10245 AERE-T/M-97

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

NUCLEAR DATA SERIES. Part II. J. S. Story. Feb. 5, 1954. 83p. (NRDC-33).

Neutron cross sections for heavy isotopes are tabulated, and the methods by which the measurements were made are discussed. (J.E.D.)

10246 UCRL-3618

California Univ., Berkeley. Radiation Lab.

NUCLEAR DECAY SCHEMES OF SOME OF THE ISOTOPES OF TANTALUM. (thesis). Frank Frederick Felber, Jr. Jan. 25, 1956. 32p. Contract W-7405-Eng-48. $6.30 (ph OTS); $3.00(mf OTS).

A nuclear spectroscopic study of the radiations resulting from the electron capture decay of Ta^{176}, Ta^{177}, and Ta^{178} is reported. Gamma-ray energies were obtained by measurement of internal conversion electron lines with 180-degree-focusing permanent magnet electron spectrographs capable of 0.1% resolution. The measurements show two rotational transitions in Hf^{176}. Their energies are 88.34 and 202.1 kev. The 112.97-kev transition in Hf^{177} was confirmed as primarily E2 with less than 3% M1 admixture. Rotational structure has also been seen in Hf^{178}. Transitions of energies 88.81, 93.17, 213.70, 325.8, 331.9, and 427.0 kev have been identified. The 88.81 was found to be a delayed E1 transition of 4.8-sec half life. The data are discussed in the light of the Bohr-Mottelson unified model of the nucleus. (auth)

10247 WASH-193

Nuclear Cross Sections Advisory Group, AEC.

REPORTS TO THE AEC NUCLEAR CROSS SECTIONS ADVISORY GROUP, DURHAM, NORTH CAROLINA, FEBRUARY 5-6, 1957. C. W. Zabel. July 10, 1957. 42p. $0.30(OTS).

Supersedes TNCC(US)-21.

Informal statements of recent developments, changes in emphasis, and preliminary data are included. Neutron scattering cross sections for the 50 and 140 kev levels in U^{238}, energy levels for Zr^{90}, Zr^{92}, and Zr^{94} from (n,γ) reactions, cross sections of Y and Ti, and neutron activation and inelastic scattering cross sections for a wide range of isotopes are given. (M.H.R.)

10248

NEUTRON ACTIVATION CROSS-SECTION GRAPHS. W. Wayne Meinke and R. S. Maddock (Univ. of Michigan, Ann Arbor). Anal. Chem. 29, 1171-4(1957) Aug.

Revised values of all known thermal neutron activation cross sections have been plotted against the half life of the radioisotope produced. The standard error of each value is included. (auth)

10249

DETERMINATION OF PARITIES AND NUCLEAR SPINS BY APPLICATION OF BUTLER'S FORMULA. F. Senent, E. Villar, and A. Bonet. Anal. real soc. espan. fis. y quim. (Madrid) Ser. A 53, 109-20(1957) May-June. (In Spanish)

Angular distributions have been obtained for the ground and the first excited state of C^{13} following a technique described in earlier papers. According to Butler's theory of the stripping process as model for the (d,p) reactions the theoretical distributions have been calculated and it is found that the ground state of C^{13} has spin $\frac{1}{2}$ or $\frac{3}{2}$ and odd parity, while the 2.99 Mev excited state has spin $\frac{1}{2}$ and even parity. (auth)

10250

CROSS SECTIONS FOR Cd(n,p)Ag REACTIONS WITH NEUTRON ENERGY AT 14 MEV. V. N. Levkovskiĭ (Inst. of Physics in Chemistry, Acad. of Sciences U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 113, 1032-4(1957) Apr. 11. (In Russian)

Calculations were made by comparing the results of β emission of the reactions with the emission of $Cd^{112}(n,\alpha)Pd^{109}$ reaction whose cross section was equal to $(1.35 \pm 0.27) \times 10^{-27}$ cm^2. Measurements of the maximum radiation energies for 24 min, 3.2 hr, 5.3 hr, and 7.5 days were in a good agreement with β decay given in literature for Ag^{106}, Ag^{111}, Ag^{112}, and Ag^{113}. The cross sections were calculated considering half lives of Ag^{106}, Ag^{111}, Ag^{112}, and Ag^{113} and content of Cd^{106}, Cd^{111}, Cd^{112}, and Cd^{113} in the natural mixture of cadmium isotopes. The Ag^{106} has an isomer T = 24 min and isomer T = 8.2 days. The data permitted the calculations of the isomer T = 24 min only. Tables of calculations are included. (R.V.J.)

10251

ON THE SPIN VALUE OF Fe^{57} NUCLEUS. N. S. Garif'yanov, M. M. Zaripov, and B. M. Kozyrev (Ul'yanov-Lenin Kazan State Univ.). Doklady Akad. Nauk S.S.S.R. 113, 1243(1957) Apr. 21. (In Russian)

Measurements were made of the paramagnetic resonance in cooled fused borax with iron content. The cylindrically shaped specimens were prepared by fusing 5 mg $FeCl_3 \cdot 6\ H_2O$ with 4g borax. One of the samples contained iron, enriched up to 71.91% with isotope Fe^{57}, the other contained a common mixture of isotopes. The measurements were taken at 77°K temperature at 115, 240, and 430 Mc frequencies. The grid current method was used to modulate the constant magnetic field H. The curves in all three frequencies were considerably wider for the enriched specimen, moreover, except in the main maximum of absorption there was observed an additional poorly resolving maximum located in fields weaker than H. The maximum of absorption for the second specimen was found between the two maxima. The analysis of the data showed that the phenomenon may be explained by ascribing the value $I = \frac{1}{2}$ to the nuclear spin of Fe^{57}. (R.V.J.)

10252

ON THE β SPECTRUM OF THE Ta^{182} NUCLEUS. Jean Demuynck, Julien Verhaeghe, and Bernard Van der Velde. Compt. rend. 244, 3050-2(1957) June 17. (In French)

10253

THE DE-EXCITATION OF C^{12} BY EMISSION OF A NUCLEAR PAIR. Radha Raman Roy, Marie-Louise Goes, and Amand Pirson. Compt. rend. 244, 3054-6(1957) June 17. (In French)

The nuclear pairs emitted during the monopolar 0-0 transition of 7.65 Mev C^{12} nuclei produced by the $Be^9(\alpha,n)C^{12}$ reaction were studied. On more than 8,000 photographs 120 pairs of electrons and positrons were observed. The distribution curves of the energies of the positrons and electrons are given. (T.R.H.)

10254

ON THE EFFECTIVE CAPTURE CROSS SECTION OF Pu-240 FOR REACTOR NEUTRONS. R. W. Stoughton and J. Halperin (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, 481-7(1957) July.

Effective reactor capture cross section values for Pu^{240} were calculated both from experimental plutonium isotopic ratios and from the resonance parameters for the 1-ev resonance. Both methods gave values of about 1200 barns for highly dilute Pu as contrasted to values of about 500 barns which have been reported for reirradiated Pu samples. The 1200 barn figure is consistent with a 2200 meter per second cross section of about 340 barns and a resonance integral of about 8300 barns. (auth)

10255

EXCITED LEVELS IN Bi^{206} FROM THE DECAY OF Po^{206} E. Arbman (Univ. of Uppsala). Nuclear Phys. 3, 625-43 (1957) July.

The energies and intensities of conversion electrons from the decay of Po^{206} have been studied in a double focusing beta spectrometer. Relative gamma intensities were measured in a scintillation spectrometer. Coincidences between pairs of conversion lines were studied in a coincidence spectrometer. No positrons were observed. A decay scheme is proposed, which contains 9 excited levels and includes 20 of the observed transitions. (auth)

10256

HYPERFINE SPLITTING IN THE $p^5\ ^2P_{\frac{1}{2}}$ METASTABLE STATE OF I^{127}. Ryumyo Onaka (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 106, 1178(1957) June 15.

The hyperfine structure of the $p^5\ ^2P_{\frac{1}{2}}$ metastable state of I^{127} was investigated by means of a vacuum echelle spectrograph. The doublet separation in the $^2P_{\frac{1}{2}}$ state was obtained as 0.667 and 0.673 cm^{-1} from λ2062 and λ1876, respectively, the mean value being 0.670 cm^{-1}. (auth)

10257

HELIUM EXCITATION CROSS SECTIONS NEAR THRESHOLD. Elizabeth Baranger (Univ. of Pittsburgh, Penna.) and Edward Gerjuoy (Univ. of Pittsburgh and Westinghouse Research Lab., Pittsburgh). Phys. Rev. 106, 1182-5(1957) June 15.

The cross section for excitation by incident electrons of the $^3S_1(1s,2s)$ metastable level of He has been fitted by using a Breit-Wigner one-level formula. The fit is very good. The significance of this result and its bearing on the energy dependence of the cross section near threshold are discussed. (auth)

10258

PROTON-NUCLEUS ELASTIC SCATTERING AT 9.8 Mev. Norton M. Hintz (Univ. of Minnesota, Minneapolis). Phys. Rev. 106, 1201-6(1957) June 15.

The differential cross section for proton-nucleus elastic scattering has been measured for Li, N, Al, A, Ni, Cu, Ag, Sn, and Au at a laboratory proton energy of 9.8 Mev. Data

were taken at 5° intervals from 15 to 170° with an estimated standard deviation of 3 to 5%. The 24-inch-diameter scattering chamber is described. The protons are detected by a NaI(Tl) crystal whose energy resolution was about 2.5% so that in almost all cases inelastic protons were rejected. The data for Al, A, Ni, Cu, Sn, and Au have been analyzed by using the optical model with the Saxon potential. Good fits are obtained for a radius constant $r_0 = 1.20$ in the formula $R = r_0 A^{1/3} \times 10^{-13}$ cm and a real well depth of 62 Mev for most elements. The imaginary well depth and the smoothing parameter are A-dependent. A brief discussion is given on the determination of nuclear radii from elastic scattering and nuclear reaction cross sections. (auth)

10259

MEASUREMENT OF THE LONGITUDINAL POLARIZATION OF POSITRONS EMITTED BY SODIUM-22. Lorne A. Page and Milton Heinberg (Univ. of Pittsburgh, Penna.). Phys. Rev. 106, 1220-4(1957) June 15.

Measurement of the preponderance of $1\ ^3S_{1,0}$ states of positronium over $1\ ^1S_{0,0}$ states formed in a gas at moderately high field H (10 to 15 kilogauss), yields directly the preponderance of positron spins opposed to H over those parallel, just prior to capture, the magnitude and sign of the Paschen-Back effect may be inferred from the field value and the known triplet-singlet energy separation at zero field. By using suitable gases, the two-photo annihilation events from $1\ ^3S_{1,0}$ are differentiated from those from $1\ ^1S_{0,0}$ by requiring strict angular correlation at 180°; positronium atoms in the latter state, being only about 10^{-10} sec old at annihilation, have retained enough of the kinetic energy at formation to yield a broad angular correlation, while the former states, being on the average 30 times older at annihilation, yield a narrow component. The relative efficiency for counting the triplet/singlet states can in practice be made ~1.5, in the presence of all other two-quantum annihilation events. Positrons emitted into the hemisphere about +z, plus those scattered by the source material of source-backing into that hemisphere, are found to be polarized along +z by an amount 0.15. Taking, for those positrons ultimately slowed and counted, that $(v/c)_{effective}$ at emission is 0.75, it is implied that their longitudinal polarization at emission is at least 0.4(v/c), this lower limit to apply if there be no back-scattering, no depolarization during the slowing process, and no de-alignment on the part of the positronium. The Na^{22} positrons are unmistakably right-handed. The sought-for connection between failure of parity conservation and polarization of betas from an unpolarized source is thus experimentally established. (auth)

10260

DECAY PROPERTIES OF Pu^{235}, Pu^{237}, AND A NEW ISOTOPE Pu^{233}. T. Darrah Thomas, Robert Vandenbosch, Richard A. Glass, and Glenn T. Seaborg (Univ. of California, Berkeley). Phys. Rev. 106, 1228-32(1957) June 15.

Electron-capture and alpha-decay properties of Pu^{237}, Pu^{235}, and the new isotope Pu^{233} have been measured. The over-all half-lives are 44 ± 2 days for Pu^{237}, 26 ± 2 m for Pu^{235}, and 20 ± 2 m for Pu^{233}. Two alpha groups, one of 5.65 ± 0.02 Mev and one of 5.36 ± 0.02 Mev, were detected in the decay of Pu^{237}, one group of 5.85 ± 0.02 Mev in the decay of Pu^{235}, and one of 6.30 ± 0.02 Mev in the decay of Pu^{233}. The partial alpha half-lives corresponding to these alpha groups are, for Pu^{237}, $(1.7 \pm 0.4) \times 10^4$ y and $(4.6 \pm 0.6) \times 10^3$ y, respectively; for Pu^{235}, (1.7 ± 0.4) y; and for Pu^{233}, 11 ± 4 d. On the basis of the experimental data it has been possible to calculate hindrance factors for the alpha decay and log ft values for the electron-capture decay of the three isotopes and to correlate their properties with the alpha and electron-capture systematics. (auth)

10261

SUM RULES FOR PHOTODISINTEGRATION OF H^3 AND He^3. M. L. Rustgi (Louisiana State Univ., Baton Rouge). Phys. Rev. 106, 1256-7(1957) June 15.

The sum rules of Levinger and Bethe are applied to calculate the dipole bremsstrahlung weighted cross section ($\sigma_b = \int_0^\infty (\sigma/W)dW$) and the integrated cross section ($\sigma_{int} = \int_0^\infty \sigma dW$) for H^3 and He^3 using Irving's wave function. On assuming charge symmetry and neglecting Coulomb repulsion, it is found that $\sigma_b(H^3) = \sigma_b(He^3)$ and $\sigma_{int}(H^3) = \sigma_{int}(He^3)$. (auth)

10262

ELECTRON SCATTERING FROM NONSPHERICAL NUCLEI. B. W. Downs, D. G. Ravenhall, and D. R. Yennie (Stanford Univ., Calif.). Phys. Rev. 106, 1285-9(1957) June 15.

To explain the anomalously smooth cross sections observed in electron scattering from certain nuclei (Hf, Ta, W, U), the contributions to the cross section arising from the nonspherical character of those nuclei have been examined. Approximations are developed for the calculation of these contributions, and for a sample case, Ta, numerical results are given; the value required for the nuclear distortion in order to obtain agreement with experiment in this case is in good agreement with the spectroscopic and Coulomb-excitation values. The results suggest that in certain cases electron scattering will be a useful new method for measuring both the magnitude and the radial shape of nuclear deformations. (auth)

10263

PARAMAGNETIC RESONANCE HYPERFINE STRUCTURE OF Np^{239}. M. Abraham, C. D. Jeffries, R. W. Kedzie, and J. C. Wallman (Univ. of California, Berkeley). Phys. Rev. 106, 1357-8(1957) June 15.

The discrepancy between the spin value of Np^{239} as measured by using optical hyperfine structure ($I = \frac{1}{2}$) and the value inferred from various decay scheme studies ($I = \frac{5}{2}$) led to the redetermination of the spin by an independent method: microwave paramagnetic resonance absorption. The results indicate $I = \frac{1}{2}$, though the possibility of an isomeric state of Np^{239} with $I = \frac{5}{2}$ was not ruled out. (M.H.R.)

10264

FURTHER EXPERIMENTS ON β DECAY OF POLARIZED NUCLEI. E. Ambler, R. W. Hayward, D. D. Hoppes, and R. P. Hudson (National Bureau of Standards, Washington) and C. S. Wu (Columbia Univ., New York). Phys. Rev. 106, 1361-3(1957) June 15.

Further measurements and checks concerning nonconservation of parity were made. In similar experiments with Co^{58} and observed an asymmetry in positron emission with a coefficient opposite in sign and roughly one third that from Co^{60}. Through more detailed measurements on Co^{60}, the general behavior of the momentum dependence of the asymmetry parameter was obtained. The linear dependence of this parameter on v/c in the range from 0.4 to 0.75 is good. (M.H.R.)

10265

POSITRON POLARIZATION DEMONSTRATED BY ANNIHILATION IN MAGNETIZED IRON. S. S. Hanna and R. S. Preston (Argonne National Lab., Lemont, Ill.). Phys. Rev. 106, 1363-4(1957) June 15.

Positrons from a Cu^{64} source impinged on the end of a cylindrical sample and the two-quantum yield was detected with two NaI counters placed 180° apart and operated in coincidence. A measurement of the angular correlation for annihilation in Cu, obtained with this technique agreed satisfactorily with previous results. With fields producing saturation in the iron sample, the normalized yield was consistently higher by (5 ± 1)% with the field parallel in-

stead of antiparallel to the direction of motion of the positrons. The effect vanished when the Cu sample was used. The yield was higher for Cu than for Fe. (M.H.R.)

10266

BETA-GAMMA CIRCULAR POLARIZATION CORRELATION MEASUREMENTS. F. Boehm and A. H. Wapstra (California Inst. of Tech., Pasadena). Phys. Rev. 106, 1364-6(1957) June 15.

The bremsstrahlung of β particles of Tm^{170} were measured. Beta-gamma coincidence measurements with Co^{60}, Au^{198}, and Hg^{203} were made. The results for Au and Hg indicate spins of $^5/_2$ and $^3/_2$, respectively. The correlation coefficients for Co, Au, and Hg are given. (M.H.R.)

10267

EXCITED STATES IN THE PROTON $f_{7/2}$ SHELL. R. D. Dawson and J. L. Uretsky (Univ. of California, Berkeley). Phys. Rev. 106, 1369-70(1957) June 15.

The excitation energies of a j^n configuration, determined by use of the experimentally measured splitting of the j^2 configuration together with the tabulated coefficients of fractional parentage, were used to make spin assignments for the excited states of nuclei with $(f_{7/2})^n$ protons and 28 (closed shell) neutrons. A summary of such predictions together with known experimental information is tabulated. (M.H.R.)

10268

HYPERFINE STRUCTURE IN MANGANESE $^{55}_{25}Mn$. G. K. Woodgate and J. S. Martin (Clarendon Lab., Oxford). Proc. Phys. Soc. (London) A70, 485-8(1957) July.

The hyperfine structure of the ground state $3d^54s^2\ ^6S_{5/2}$ of Mn^{55} has been measured in a resonance experiment with an atomic beam. The value $^5/_2$ for the nuclear spin has been confirmed by measurements in weak fields. The magnetic dipole interval factor is $A(^6S_{5/2}) = 72.422 \pm 0.002$ Mc/s. There is no departure from the interval rule outside experimental error. (auth)

10269

WEAK COLLECTIVE EFFECTS IN THE NUCLEAR SHELL MODEL. R. D. Amado and R. J. Blin-Stoyle (Clarendon Lab., Oxford). Proc. Phys. Soc. (London) A70, 532-5 (1957) July.

Eigenstates generated by considering particles moving independently in a spherically symmetric potential well are, according to the shell model, good approximations for calculating the ground state and low-energy properties of nuclei, particularly near closed shells. But even for nuclei differing by only one particle from a closed shell, weak collective effects have been found that can only be explained by calling into play most or all of the particles in the closed-shell core. An approach is proposed in which the residual two-body interaction between the odd particle and the core is used as a perturbation to mix in excited core configurations. The perturbed wave function is then used to calculate the matrix element of the electric quadrupole operator. (M.H.R.)

10270

ELECTRON COLLISION PARTIAL CROSS SECTIONS FOR THE 1s-2s AND 1s-3s TRANSITIONS OF ATOMIC HYDROGEN. D. R. Bates and D. Miskelly (Queen's Univ. of Belfast). Proc. Phys. Soc. (London) A70, 539-42(1957) July.

General expressions for the partial cross sections and extensive numerical results are presented. (M.H.R.)

10271

BANDS ASSIGNED TO ZrF. P. K. Carroll and P. J. Daly (Univ. Coll., Dublin). Proc. Phys. Soc. (London) A70, 549-50(1957) July.

The bands ascribed to ZrF by Afaf were sought and could only be found using a low voltage Cu arc. Comparison with spectra of known systems of CuF indicates that these were not ZrF bands but those of CuF. (M.H.R.)

NUCLEAR REACTORS

10272 AECD-4240

Los Alamos Scientific Lab., N. Mex.

BOOBY TRAPS. [Hugh Paxton. 1957.] Decl. June 18, 1957. 18p. [Contract W-7405-eng-36.] $4.80(ph OTS); $2.70(mf OTS).

Situations that have led to accidental prompt-critical radiation bursts in critical assemblies are outlined briefly, and a few others that appeared to be risky are mentioned. Diagrams and pictures of the experimental arrangements and criticality graphs are included. (M.H.R.)

10273 AECU-3509

Los Alamos Scientific Lab., N. Mex.

HYDRO CRITICAL ASSEMBLY. J. A. Grundl, F. W. Korbitz, and B[etty] A. Lindsey. 23p. Contract W-7405-eng-36. $4.80(ph OTS); $2.70(mf OTS).

Hydro, a cylindrical, water-reflected, water-cooled enriched uranium metal critical assembly (about 36 kg), has been in operation since June 1, 1956. Ordinary water reflector is added to the sides of the core by remote control, and a polyethylene cylinder is positioned at the bottom of the core to adjust the reactivity of the system. Hydro will be used as a neutron source in experiments requiring power levels up to 3 kw. These include exponential column and fission spectra measurements and radiochemistry calibrations. The machine is portable, and for some experiments it can be installed in an outdoor facility which includes a shielded vault for storage after operation. (auth)

10274 AERE-R/R-2192

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

STUDIES ON THE OCCURRENCE OF UNDAMPED OSCILLATIONS IN A CIRCULATING LIQUID METAL FUEL REACTOR. J. J. Thompson. Feb. 1957. 12p. (LMFR/P-6).

The conditions for oscillatory instability in the core of a circulating fuel reactor have been investigated using the linearized equations for slug flow, with no delayed neutrons, constant moderator and inlet temperature, but with the variation of power density and reactivity weighting function along the axis given by simple functions likely to be approximated in practice. It is found that the range of constants for a proposed system will ensure that all oscillations are damped, further safeguards being provided by the stabilizing effect of the delayed neutrons and the dispersion of fuel transit times. The effect of the moderator has been included in a further numerical calculation to establish the stability boundaries in terms of the overall fuel and moderator temperature coefficients of reactivity and the temperature rise through the core, and to determine the accuracy of the criteria derived on the assumption that the mean temperature is the arithmetic mean of inlet and outlet temperatures. Although applicable to a simple model only the results indicate that all oscillations should be damped in the operating range of the reactor. Where stability is marginal, the use of this assumption leads to faulty predictions. (auth)

10275 APAE-Memo-87

Advanced Scientific Techniques Research Associates, Milford, Conn.

PUMP FAILURE AND THE APPR-1. J. Frank Coneybear, Willard P. Berggren, Archie W. Culp, Jr., Fred R. Grisak, and Henry R. Kroeger. May 1956. 180p. For [Alco Products, Inc. Contract AT(11-1)-318]. (ASTRA-415-E-4-1). $1.00(OTS).

Studies were undertaken to determine the allowable time between coolant pump failure and scram in the APPR-1. The reactor was assumed to be operating at full power. The results indicate the reactor need not be scrammed for an indefinite period if the water volume and pressure on the secondary side of the heat exchanger remains approximately constant. It applies in any case for times of the order of minutes. In obtaining the results, primary flow momentum and free convection effects were investigated, as well as the relationship of temperature, reactivity, and power. (D.E.B.)

10276 APDA-107

Atomic Power Development Associates, Inc., Detroit.
DESCRIPTION AND SOME SAFEGUARD ASPECTS OF PROPOSED DEVELOPMENTAL FAST NEUTRON BREEDER REACTOR. July 25, 1955. Decl. Jan. 7, 1957. 122p.

The subject reactor is a U^{235} fueled, Na cooled, power breeder designed for a heat output of 300 Mw. Design parameters and descriptions are given. Two types of fuel elements, pins and plates, are evaluated. Reactor control, fuel handling and cycling, nuclear and physical properties of materials, and site location are discussed. (D.E.B.)

10277 BNL-300

Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] MAY 1954. R. W. Powell. Decl. Sept. 21, 1956. 21p. $3.30(ph OTS); $2.40(mf OTS).
(For preceding period see BNL-295.)

10278 BNL-318

Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] OCTOBER 1954. R. W. Powell. Decl. Sept. 21, 1956. 23p. $4.80(ph OTS); $2.70(mf OTS).
(For preceding period see BNL-313.)

10279 BNL-3145

Brookhaven National Lab., Upton, N. Y.
CRITICAL ASSEMBLIES OF LIFHT WATER MODERATED, SLIGHTLY ENRICHED URANIUM ROD LATTICES AT BROOKHAVEN. Hazards Report. Herbert Kouts. Feb. 28, 1956. 25p. $0.25(OTS).

Descriptions are given of series of critical experiments with lattices of slightly enriched U rods moderated by light water. The experiments were carried out to supplement and extend the current series of exponential experiments on similar assemblies. A revised list of safety rules is included. (R.V.J.)

10280 CF-57-4-92

Oak Ridge National Lab., Tenn.
MAINTENANCE OF VARIOUS REACTOR TYPES. B. D. Draper. Apr. 8, 1957. 26p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Maintenance of reactor power plants is more complex than conventional fossil fired steam turbo-generator plants because of the presence of radioactivity either localized in the reactor vessel or scattered throughout the circulating loops depending upon the reactor type. It is obvious that the easiest systems to operate and maintain are those which permit the use of conventional tools and techniques on a large portion of the reactor auxiliaries. Following is a list of reactor power plant types, arranged in order of increasing difficulty of maintenance in the opinion of the author with advantages and disadvantages maintenance-wise of each. (auth)

10281 CRT-682

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE ENRICHMENT COST OF POWER INCREMENTS GAINED BY FLATTENING AND BY CLOSE ROD SPACING. B. Davison and H. H. Clayton. Apr. 1957. 95p. (AECL-446).

The enrichment of U required to produce radially flat power per rod in the axial region of a cylindrical reactor of fixed over-all dimensions is calculated. If the condition be imposed that the power per unit length of rod at the mid length of the "hottest" rod have a fixed value a cost in enrichment of the power increment produced can be stated in the form $C = \Delta U^{235}/(\Delta P/P)$. It is found, for the particular reactor chosen, that significant power increments can be produced by quite moderate amounts of additional U^{235} Graphs and tables are given of the radial distribution of thermal flux, enrichment, power per rod, and U^{235} to Pu^{239} conversion ratio; of the U^{235} investment, power output, and efficiency of utilization of fissile material as functions of the radius of the flattened region; and of the cost in enrichment as function of the logarithmic power increment produced. (auth)

10282 E-443/N-36

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
ARGON ACTIVITY ASSOCIATED WITH DIDO. V. S. Crocker. Jan. 3, 1956. 4p.

10283 HARD(C)/P-41

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
CORE SOLUTION STABILITY IN THE HOMOGENEOUS AQUEOUS REACTOR; THE EFFECT OF CORROSION PRODUCT AND COPPER CONCENTRATIONS. F. Moseley. May 1957. 15p.

Synthetic solutions representing homogeneous aqueous reactor core solutions have been tested to determine the temperature at which a second phase separates. The variables studied have included the uranium, chromium, nickel, copper, and sulfuric acid concentrations. Graphs are given at the end of the paper to show the results obtained and to illustrate the regions of temperature and concentration in which stable reactor solution conditions will prevail. (auth)

10284 HW-48907

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
KINETIC BEHAVIOR OF A URANIUM–PLUTONIUM–D_2O SYSTEM. D. T. Houser and M. V. Davis. Mar. 11, 1957. 24p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70 (mf OTS).

The study of the kinetic behavior of a D_2O moderated nuclear reactor fueled with a combination of U^{235} and Pu^{239} is presented. From this system there are primary neutrons formed from fissions and from the instantaneous $D(\gamma,n)H$ reaction in the moderator. The threshold for the $D(\gamma,n)H$ is at approximately 2.2 Mev, so a considerable fraction of the neutrons in the system have their origin in the moderator. The reactor transients are not primarily concerned with the prompt neutrons but with the neutrons that make their appearance at a time later than that of the original fission. The delayed neutrons are from the neutron-rich fission fragments and from the delayed gamma emission from the fragments. These neutrons will be termed delayed neutrons and will be those neutrons that are formed at least 0.1 sec after the original fission. The analytical discussion of this problem is presented. (auth)

10285 IDO-16341

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
THE SPERT-III REACTOR FACILITY PRELIMINARY DESIGN REPORT. T. R. Wilson. May 6, 1957. 31p. Contract AT(10-1)-205. $0.25(OTS).

The SPERT-III reactor is designed for conducting basic

transient and reactor safety studies under conditions encountered in high power, heterogeneous, light water reactors. The reactor and primary coolant system are designed for operation up to 2500 psi and 650°F. Coolant flow rates up to 20,000 gpm are provided with heat removal capacity sufficient for 60 Mw for approximately 30 minutes. A description and preliminary design data report of the facility are presented. (auth)

10286 KAPL-M-PL-1
Knolls Atomic Power Lab., Schenectady, N. Y.
INVESTIGATION OF ACTIVATION FOILS FOR S3G FLUX DISTRIBUTION MEASUREMENTS. P. G. Lacey, E. B. Fehr, and M. E. Way. Mar. 21, 1957. 20p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Calculations and experimental investigations were made to determine the best activation for flux distribution measurements in SAR. Copper and manganese were found to give equivalent results to U^{235}, and Cu is recommended because of its longer half life (12.8 hours). (auth)

10287 NAA-SR-1949
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ANALYSIS OF THE BIOLOGICAL SHIELD OF THE SODIUM REACTOR EXPERIMENT. A. R. Vernon. June 15, 1957. 26p. Contract AT(04-3)-49. $0.25(OTS).

The computations performed to determine the radiation leakage from the Sodium Reactor Experiment biological shield are described. Simple formulas, suitable for rapid desk computations have been developed for all the separate contributions to the radiation dose rate. In performing the calculations of gamma-ray penetration, a quadratic approximation was used to represent the buildup of scattered radiation. The formulas and approximations used are probably adequate for analysis of most large stationary reactors, but are generally unsuitable for mobile reactors except for preliminary estimates. (auth)

10288 NAA-SR-1963
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
FLUX DISTRIBUTION FOR A FINITE CYLINDRICAL BARE HOMOGENEOUS THERMAL REACTOR WITH A PARTIALLY INSERTED CONTROL ROD. E. J. Betinis. July 1, 1957. 19p. Contract AT(04-3)-49. $0.20(OTS).

One-group diffusion theory is employed to determine the flux for a large but finite cylindrical bare homogeneous reactor with a control rod inserted partially along the axis of the reactor. A critical equation is derived for the buckling. (auth)

10289 NAA-SR-Memo-1021
North American Aviation, Inc., [Downey, Calif.]
SRE CRITICALITY ANALYSIS. F. L. Fillmore. June 16, 1954. Decl. Oct. 14, 1955. 61p. $10.80(ph OTS); $3.90 (mf OTS).

10290 NAA-SR-Memo-1639
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SRE INSTRUMENTATION AND CONTROL. R. J. Hall. May 21, 1956. 78p. $0.90(OTS).

General descriptions of SRE control components and equipment associated with all reactor services are given. Included are the nomenclature, a statement giving the function of each instrument, and in some cases a description of the theory of operation. References are made giving the equipment location. (D.E.B.)

10291 NP-6338
Mine Safety Appliances Co., Callery, Penna.
PROGRESS REPORT NO. 40 FOR APRIL AND MAY 1957. W. J. Posey, ed. June 13, 1957. 26p. Contract NObs-65426.

Hydrodynamic testing of CVR flow channels continued. Other pressurized-water reactor studies reported are: small-scale radioactive leaks in cooling system, simulation of a major pressurized water system rupture, unstable film boiling with water inside tubes, fission product release during core meltdown simulation, radioactivity associated with crud particle size ranges, and chromate formation in high temperature water systems. (For preceding period see NP-6260.) (T.R.H.)

10292 TID-7540
Oak Ridge National Lab., Tenn.
HRP CIVILIAN POWER REACTOR CONFERENCE HELD AT OAK RIDGE NATIONAL LABORATORY, MAY 1-2, 1957. R. B. Briggs, comp. July 1957. 306p. $1.60 (OTS).

Eighteen papers on the design, operation, and maintenance of homogeneous reactors and the properties of reactor slurries and solutions are included. (D.E.B.)

10293 UCRL-4880
California. Univ., Livermore. Radiation Lab.
CRITICAL MASS MEASUREMENTS ON GRAPHITE U^{235} SYSTEMS. James E. Carothers. Apr. 11, 1957. 15p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

Measurements have been made on pseudo-cylindrical graphite–enriched uranium unreflected systems. These measurements include both critical mass determinations and time-dependent measurements using a pulsed neutron source to drive the assemblies. (auth)

10294 WAPD-169
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
EXPERIMENTAL AND THEORETICAL STUDY OF CRITICAL SLABS. EFFECT OF DIFFERENT REFLECTOR ARRANGEMENTS AND COMPOSITIONS. C. E. McFarland and A. D. Voorhis. Apr. 1957. 104p. Contract AT-11-1-GEN-14. $0.55(OTS).

Data are presented from critical slab experiments with a thin core of enriched U^{235}, H_2O, and Zr which were surrounded by reflectors of different compositions and arrangements. The reflectors studied were composed of water, Zr-water, and Al-water. In some experiments the cores were bisected by water gaps. Each critical assembly was analyzed by one-dimensional, group diffusion theory using digital codes. The calculated neutron multiplications from a four-group scheme predict criticality in most of the experiments within 1%, and from a two-group scheme within 3%. Calculated neutron flux distributions are fitted with experimental traverses of subcadmium and epicadmium activation (of Mn). The accuracy of the calculations with regard to input data and method is discussed. (auth)

10295 WAPD-SC-530
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
SUMMARY REPORT ON REACTOR HAZARDS ASSOCIATED WITH THE PRESSURIZED WATER REACTOR—FLEXIBLE ASSEMBLY. H. A. Morewitz, E. R. Sanford, and J. J. Taylor. Oct. 1, 1954. Decl. Jan. 31, 1957. 140p. Contract AT-11-1-GEN-14. $0.70(OTS).

Appendix G of this report issued as WAPD-PM-1, "IRRADIATION OF PLASTIC FUEL TAPES," by R. T. Jones and W. F. Witzig.

The Pressurized Water Reactor–Flexible Assembly (PWR-FA) is primarily intended as a reactor development facility for the PWR plant which is to be installed at the Duquesne Light Company site in Pennsylvania. This facility is to be used in conjunction with the two region reactor TRX to provide detailed design information and later full scale mockup facilities for the proposed nuclear designs of the PWR. (W.L.H.)

10296 WAPD-TH-225
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
UPFLOW BURNOUT DATA IN VERTICAL RECTANGULAR CHANNELS AT 2000 PSIA. R. A. DeBortoli, J. D. Roarty, and M. Troy. Oct. 10, 1956. 23p. $4.80(ph OTS); $2.70 (mf OTS).

10297 WAPD-TH-276
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
UPFLOW BURNOUT DATA FOR 0.059 in. × 1 in. × 27 in. LONG RECTANGULAR CHANNELS AT 2000 PSIA. M. Troy and J. D. Roarty. Dec. 11, 1956. 13p. $3.30(ph OTS); $2.40(mf OTS).

10298 WAPD-TH-289
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh].
UPFLOW BURNOUT DATA FOR 0.101 in. × 1 in. × 6 in. VERTICAL RECTANGULAR CHANNELS AT 2000 PSIA. R. Masnovi and M. Troy. Jan. 8, 1957. 10p. $1.80 (ph OTS); $1.80(mf OTS).

10299 WAPD-TM-32
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
POWER PEAKING AT ROD CHANNELS. R. S. Halgas. Dec. 1956. 58p. Contract NObs-67500.

Power peaking in rod channels (water holes) is investigated for a variety of cases to determine the magnitudes of the power peaks as well as methods to reduce them. One- and two-group one-dimensional diffusion theory are applied to an infinite slab cell representative of a hot, clean highly enriched cell to determine the ratio of peak-to-average power in the cell. All results given are for only one-dimensional peaking effects; an estimate of the total two-dimensional peak for an approximately spatially separable flux situation can be determined by multiplying the respective peak power ratios in each dimension. The results of the diffusion theory give the following indications. Nonuniformities in regional loading near the water channel reduce the power peaking, and this reduction may be maintained over core life. Insertion of an infinitely thin or finite-sized poison strip between the water hole and multiplying region reduces the power peaking from 1.35 to 1 at beginning of life. Use of a nonburnable poison, although maintaining this peak power ratio over life, is restrictive in the excessive loss of reactivity. A burnable poison eliminates this reactivity loss at the expense of increasing the peak power ratio to 1.18 for a uniform burnout of the cell. The inclusion of a burnable poison (B^{10}) in the Zr extensions reduces the peak power ratio to 1.09 over core life but causes additional loading for maximum Xe override at beginning of life without aiding the cold shutdown of the core. Nonuniform burnout of a highly enriched cell indicates rapid reductions in the power peaking at water holes under clean and maximum Xe conditions. Slight increases in the power peaks occur for the control rod region clean and maximum Xe conditions. No appreciable decrease in the water hole power peaking occurs if fast fissioning is considered in a typical highly enriched cell. (auth)

10300 WAPD-TM-47
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
APPROXIMATE SPATIALLY SEPARABLE FLUX CALCULATIONS. Robert S. Halgas. Mar. 1957. 55p. Contract AT-11-1-GEN-14. $0.40(OTS).

The preliminary results of a spatial separability of flux technique which allows approximate solution of multidimensional group diffusion equations are presented with a comprehensive derivation of the technique. Comparative analysis with digital multidimensional critical calculations and experimental measurements for highly enriched, water moderated cores are in excellent agreement. Extensions of the technique to the analysis of inhomogeneous reactors throughout lifetime are discussed. (auth)

10301 WAPD-TM-51
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE ZIRCALOY-2 IN-PILE TUBE FOR THE NRX CENTRAL THIMBLE. Richard M. Lieberman. Apr. 1, 1957. 119p. Contract AT-11-1-GEN-14. $0.60(OTS).

The design, fabrication, and testing of the first Zircaloy-2 in-pile tube built for use in the Central Thimble Facility of the NRX Reactor at Chalk River, Ontario, Canada, are described. (auth)

10302 WCAP-225
Westinghouse Electric Corp. Commercial Atomic Power, Pittsburgh.
THE EFFECT OF NEUTRON SOURCES IN A SUBCRITICAL REACTOR. W. H. Arnold, Jr., and S. Bartnoff. June 1956. 30p. $4.80(ph OTS); $2.70(mf OTS).

The steady state effect of a source in a subcritical reactor was treated using two group diffusion theory. Source neutrons which do not have the same characteristics as fast group neutrons are treated as a distributed source in the slow group. Equations are derived for the treatment of central and eccentric sources in spherical and cylindrical reactors. Results are presented which were calculated for the Belgian Thermal Reactor in cylindrical geometry. (auth)

10303 YAEC-1
Westinghouse Electric Corp. Commercial Atomic Power, Pittsburgh.
YANKEE ATOMIC ELECTRIC COMPANY RESEARCH AND DEVELOPMENT PROGRAM. REFERENCE DESIGN—JULY 20, 1956. May 29, 1957. 23p. For Yankee Atomic Electric Co., Boston. Contract AT(30-3)-222. $4.80(ph OTS); $2.70(mf OTS).

The reference design parameters for the pressurized light water moderated and cooled reactor are presented. The mechanical, thermal and hydraulic, and nuclear considerations are given. The reactor is fueled with 2.6 atom % enriched UO_2 in the form of sintered pellets which are clad in stainless steel. The reactor is designed to operate at 2000 psi and 628° for 10,000 hours. There is no bulk boiling in the reactor, however, local boiling is allowed within the core. The reference core is designed to generate 134,000 Mw net electrical output. (auth)

10304
COOLANT GAS CIRCUIT AND STEAM RAISING PLANT. R. H. Bird. Atomics 8, 245-50(1957) July.

Problems involved in insuring maximum efficiency in the power train between gas-cooled reactor and electric generator are treated. The gas ducting, gas valves, gas circulators, and steam generator for the South of Scotland Electricity Board nuclear power station at Hunterston, Ayrshire, are described and discussed. (T.R.H.)

10305
SOME DEVELOPMENTS IN REACTOR CALCULATIONS. P. A. Egelstaff and J. H. Tait (Atomic Energy Research Establishment, Harwell). Atomics 8, 251-4(1957) July.

Applications of numerical methods to solving equations in reactor design are given. The Monte Carlo method, neutron spectrum in a thermal reactor, fission product poisoning, transport theory and the diffusion approximation, and shielding calculations are briefly discussed. (T.R.H.)

10306
THE CHEMICAL GROUP AT DOUNREAY. Atomics 8, 255-7(1957) July.

10307
AEC'S FIRST BIG TEST REACTOR GOES CRITICAL DEMONSTRATING COMMERCIAL ATOMIC POWER. Chem. Eng. 64, No. 8, 230-3(1957) Aug.

The Argonne Experimental Boiling Water Reactor feeds 5,000 kw of electricity continuously to laboratory. Steam from the core is coupled directly to the turbine, side-stepping usual costly intermediate exchangers. (auth)

10308
CHEMISTRY OF PROCESSES CONCERNING NUCLEAR REACTORS AT THE GENEVA INTERNATIONAL CONFERENCE ON PEACE-TIME USES OF ATOMIC ENERGY. M. A. Rollier. Chimica e industria (Milan) 38, 109(1956) Feb. (In Italian)

The author underlines the fact that the great majority of papers on nuclear reactor chemistry at the Geneva Conference was submitted by scientists from the United States of America. This is evidence of a strong trend toward declassification. The survey of the reactor chemistry is divided in four sections: chemical problems of nuclear reactors during operation, the chemistry of reprocessing of spent nuclear fuels, the various separation processes of industrial significance, and the problem of radioactive waste storage and disposal. Particular attention is paid to a comparison between the decontamination factors of the different kinds of chemical separation of uranium, plutonium, and the fission products. (tr-auth)

10309
THE REACTORS OF THE WORLD. SURVEY TO THE MIDDLE OF 1956 ON OPERATION, STRUCTURE, AND PLANNING OF PRESENT NUCLEAR REACTORS. Rud. Schulten and Wolfgang D. Müller. Die Atomwirtschaft No. 7/8, 9, and 10, 48p.(1956). (In German)

10310
EXCITED LEVELS IN ARSENIC-75 PRODUCED BY RADIATIVE CAPTURE OF PROTONS BY GERMANIUM-74. D. R. Chick and S. E. Hunt (Associated Electrical Industries, Ltd., Aldermaston, Berkshire). Nature 180, 88-9(1957) July 13.

10311
PROMPT NEUTRON PERIODS OF METAL CRITICAL ASSEMBLIES. John D. Orndoff (Los Alamos Scientific Lab., N. Mex.). Nuclear Sci. and Eng. 2, 450-60(1957) July.

Measurement of the time distribution of pairs of counts due to neutrons originating from a common ancestor in a neutron chain yields a value for the prompt neutron period of a near-critical system. Such measurements can be used to establish the mass or control increment between delayed and prompt critical and, hence, constitute a reactivity calibration without use of the Inhour relation. Measurements are reported for several simple metal critical assemblies. (auth)

10312
APPLICATION OF MINIMUM LOADING CONDITIONS TO ENRICHED LATTICES. P. L. Hofmann and H. Hurwitz, Jr. (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, 461-8(1957) July.

The distribution of enrichment which makes a natural uranium lattice with $k_\infty < 1$ critical with the smallest amount of added U^{235} is calculated on the basis of a simple model. The results are generalized to the minimization of total enrichment cost when this cost is a nonlinear function of the added fissionable material. (auth)

10313
OSCILLATIONS IN THE POWER DISTRIBUTION WITHIN A REACTOR. A. F. Henry and J. D. Germann (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, 469-80(1957) July.

In a reactor of sufficient size and operating at sufficiently high power density, an oscillation in the spatial distribution of power may arise because of interplay between the effect of Xe^{135} on flux distribution and the fact that its appearance after fission is delayed by the decay time of I^{135}. By use of a very simple reactor model the conditions required to establish such an instability are studied; amplitude and frequency characteristics of the oscillation are also investigated. (auth)

10314
UO_2–NaK SLURRY STUDIES IN LOOPS TO 600°C. B. M. Abraham, H. E. Flotow, and R. D. Carlson (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, 501-12(1957) July.

Suspensions of UO_2 in NaK alloy are being studied as possible reactor fuels. Two loops have so far been constructed of one-half inch stainless steel tubing with a test volume of approximately 150 cc. The Mark I loop was operated for 400 hours between 450 and 600°C, while circulating a slurry of 4.3 volume % UO_2 (36.0 weight per cent). The radioactive monitor indicated that the slurry was uniformly suspended at a flow rate of 2 ft/sec. It was found that above 500°C the UO_2 dropped out of suspension but was immediately resuspended when the temperature dropped below the critical value of 500°C. The effect was reversible and could not be eliminated even at the fastest flows. The Mark II loop incorporated a density measuring device in order to correlate the radioactivity monitor with the density of the slurry. It was found, as previously suspected, that when the counts reached maximum value the density also was a maximum, at the calculated value. One gram of powdered uranium metal added to the loop with the UO_2 completely eliminated the settling above 500°C observed in the Mark I loop. There was no evidence for corrosion or erosion of the loop, and the particle size of UO_2 was practically unchanged after operation at the high temperature. The UO_2 could be resuspended immediately after prolonged settling. (auth)

10315
MEASUREMENTS WITH A PULSED NEUTRON SOURCE. K. H. Beckurts (Max-Planck-Inst. für Physik, Göttingen, Germany). Nuclear Sci. and Eng. 2, 516-22(1957) July.

The pulse method has been applied to problems of neutron diffusion in graphite. By measuring the decay constant of the neutron flux emanating from various graphite pile geometries, the diffusion coefficient and the absorption cross section can be determined with great precision. In comparison to an exponential experiment, the quantity of graphite necessary for an accurate determination of the diffusion length can be considerably reduced. The finite geometry of the moderator gives rise to a diffusion-cooling effect on the neutron equilibrium temperature which can be understood quantitatively by a direct measurement of the heat transfer from the neutron gas to the lattice. In the second part of the work, the pulse method is used to determine the influence of eccentric control rods on the buckling of a cylindrical reactor model. (auth)

10316
CRITICAL EQUATION FOR THE BARE WATER-MODERATED REACTOR. R. Wakabayashi and Y. Fukai (Tokyo Shibaura Electric Co., Japan). Nuclear Sci. and Eng. 2, 525-7(1957) July.

A critical equation for the bare water-moderated reactor was derived using the Goertzel-Selengut method. Neutron slowing down was assumed to be due to hydrogen alone, and the fission source was taken as monoenergetic. (L.T.W.)

10317
ENGINEERING TEST REACTORS WITH LARGE CENTRAL IRRADIATION CAVITIES. George Safonov (RAND Corp.,

Santa Monica, Calif.). Nuclear Sci. and Eng. 2, 527-30 (1957) July.

10318

NUCLEAR ENGINEERING. Charles F. Bonilla, ed. New York, McGraw-Hill Book Company, Inc., 1957. 859p. $12.50.

The basic principles of the main engineering disciplines involved in the design of nuclear reactor cores and power plants are given. Topics are included on nuclear particles, nuclear physics, particle detection, basic concepts of radiation protection, elementary reactor physics, shielding of power reactors, liquid flow, heat removal, metallurgy of U and U alloys, thermal-stress analysis and mechanical design, instrumentation and control, power generation, nuclear reactor types, and legal aspects of nuclear power. (M.H.R.)

NUCLEAR TRANSFORMATION

10319

PHOTONEUTRON EMISSION FROM Th^{232}, U^{333}, U^{238}, AND Pu^{239}. L. Katz, K. G. McNeill, M. LeBlanc, and F. Brown (Univ. of Saskatchewan, Saskatoon and Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Phys. 35, 470-6 (1957).

Measurements have been made of the numbers of neutrons emitted by the fissile materials Th^{232}, U^{233}, U^{238}, and Pu^{239} under irradiation by betatron x-rays of various energies up to 23 Mev. Yield curves and corresponding cross section curves are given for these nuclides. At low x-ray energies it is found that the yield curves differ from those found with non-fissile heavy elements, corresponding to the fact that even at zero x-ray energy the fissile materials suffer (spontaneous) fission. (auth)

10320

RADIOCHEMICAL STUDY OF FISSION PRODUCTS OF HIGH ENERGY SPALLATION OF SEPARATE COPPER ISOTOPES. A. N. Murin and I. A. Yutlandov (Leningrad State Univ.). Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk, 408-13(1957) Apr. (In Russian)

The high-energy spallation of separate Cu isotopes by 660-Mev protons was studied in a synchrocyclotron. The yield of radioactive products from the reaction was determined, and the general surface of the fission yields was constructed. (R.V.J.)

10321

ANGULAR CORRELATIONS IN HIGH ENERGY FISSION. L. Marquez. Nuovo cimento (10) 5, 1646-50(1957) June.

The existence of an angular correlation between the incident beam of nucleons and the fission fragments in high-energy fission of heavy elements leads to the conclusion that the number of neutrons evaporated before fission is probably zero or very small. (auth)

10322

NUCLEON-SURFACE INTERACTION AND THE (p,n) REACTIONS. J. Sawicki and Z. Szymanski (Polish Academy of Sciences, Warsaw). Nuovo cimento (10) 5, 1777-81 (1957) June.

10323

NEUTRON THRESHOLDS IN THE $Co^{59}(p,n)Ni^{59}$ REACTION. J. W. Butler, K. L. Dunning, and R. O. Bondelid (U. S. Naval Research Lab., Washington). Phys. Rev. 106, 1224-7 (1957) June 15.

The $Co^{59}(p,n)Ni^{59}$ reaction has been used to find energy levels in the residual Ni^{59} nucleus by a neutron-threshold technique. Thresholds were found at bombarding energies corresponding to excited states of 0.341, 0.439, 1.22, 1.343, 1.79, 1.964, 2.15, 2.545, 2.72, 3.054, and 3.19 Mev. On the basis of these levels in Ni^{59}, some of the thermal-neutron-capture gamma rays from natural nickel reported by Kinsey and Bartholomew have been given new isotopic assignments. (auth)

10324

CROSS SECTION FOR THE $Be^9(n,\alpha)He^6$ REACTION. P. H. Stelson and E. C. Campbell (Oak Ridge National Lab., Tenn.). Phys. Rev. 106, 1252-5(1957) June 15.

The cross section for the reaction $Be^9(n,\alpha)He^6$ has been measured for neutron energies of 0.7 (threshold) to 4.4 Mev. The cross section exhibits a smooth rise from less than 0.1 mb at the expected threshold to a broad maximum 104 ± 7 mb at 3.0 Mev, followed by a gradual decrease to 70 mb at 4.4 Mev. (auth)

10325

ANGULAR CORRELATIONS IN THE $F^{19}(p,\alpha\gamma)O^{16}$ REACTION. H. J. Martin, W. A. Fowler, C. C. Lauritsen, and T. Lauritsen (California Inst. of Tech., Pasadena). Phys. Rev. 106, 1260-5(1957) June 15.

Angular correlation patterns in the $F^{19}(p,\alpha\gamma)O^{16}$ reaction, between alpha particles leading to the 6.13-Mev excited state of O^{16} and the corresponding gamma rays, have been measured for proton bombarding energies of 873, 935, 1250, 1280, 1346, and 1372 kev. The patterns confirm earlier spin and parity assignments and permit quantitative determination of the relative importance of high orbital angular momenta in the formation and decay of Ne^{20} states. In two cases, the higher l-values participate much more strongly than might be expected from elementary barrier considerations. (auth)

10326

ON THE INTERPRETATION OF HIGH ENERGY FISSION. L. Marquez (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil). Proc. Phys. Soc. (London) A70, 546-8 (1957) July.

It is pointed out that the average energy of the neutron emitted in the fission of U with 147 Mev protons is much greater than 2.7 Mev and that the ratio N_0/N_{90} (neutrons parallel to fission fragments/neutrons perpendicular to fission fragments) of 1.27 ± 0.11 is compatible with the emission of all the neutrons from the fragments. (M.H.R.)

PARTICLE ACCELERATORS

10327 AERE-G/M-145

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A WAVEGUIDE INCORPORATING A HELICAL CONDUCTOR. R. B. R.-Shersby-Harvie and J. R. Day. Jan. 9, 1953. Decl. Apr. 2, 1957. 17p.

A waveguide is considered, which consists of a circular corrugated pipe or any equivalent form of E_0 waveguide with a concentric helical conductor inside it. The main object of this paper is to record the basic formulae governing such a waveguide as a basis for further numerical work. Certain numerical examples are also quoted as a guide to the qualitative performance which may be expected from other designs. This kind of waveguide is of interest in connection with linear accelerators and has also certain features of general interest in waveguide design. (auth)

10328 AERE-GP/M-147

Gt. Brit. Atomic Energy Research Establishment, Harwell, England.

LINEAR ACCELERATOR FOCUSING BY PERIODIC CHANGING OF THE SYNCHRONOUS PHASE POSITION. L. B. Mullett. Mar. 26, 1953. 18p.

A method of overcoming the Incompatability theorem

(that in an accelerator it is impossible to achieve at one time both radially and axially stable motion) is described which uses only the normal r-f fields, and does not obstruct the beam. The accelerator is sectionalized into focusing and bunching regions. The radial equation of motion is solved by accepted methods of approximation, and the focusing region is found to extend into the bunching region. The phase motion can be analyzed in a similar way but unfortunately there is no justification for believing that results so obtained are more than qualitatively true. The analysis does however indicate than an accelerator so designed would be both inefficient and critical, and while it may rival the use of grids and foils when high energies are required, it cannot compare at all favorably with a machine employing an electrostatic or a magnetic means of focusing. (auth)

10329 COO-178

Purdue Research Foundation, Lafayette, Ind.

BASIC RESEARCH WITH HIGH ENERGY ELECTRONS AND X-RAYS PRODUCED BY A 300 MEV SYNCHROTRON. Progress Report. June 15, 1956. 54p. Contract AT(11-1)-123. $0.40(OTS).

Addition of capacitors to the capacitor bank has increased operating efficiency and reliability, and makes possible an increase in the peak bremsstrahlung energy to the order of 350 Mev. Further work on equipment included development of a large-volume liquid scintillator, a broom magnet for sweeping charged particles out of the bremsstrahlung beam, assembly of coils for the cloud chamber, sectors for a new plastic donut, and further work on the injection gun system to provide high injection voltages. Experimental arrangement and results are given for the experiment on the angular dependence of the Z dependence of the photoproton cross section. Some values of the differential cross sections for photodisintegration of the deuteron at forward and backward angles are given. Differential cross sections for photomeson production in tin are included. (M.H.R.)

10330

THE DESIGN OF WEDGE FILTERS FOR USE WITH A 4-MEV LINEAR ACCELERATOR. F. W. Tranter (Christie Hospital and Hold Radium Inst., Manchester). Brit. J. Radiol. 30, 329-30(1957) June.

10331

A NON-LINEAR THEORY OF PHASE OSCILLATIONS INDUCED BY RADIATION FLUCTUATIONS IN SYNCHROTRONS. A. N. Matveev (State Univ., Moscow). Nuovo cimento (10) 5, 1782-3(1957) June.

10332

NONSTATIONARY CIRCULATING CURRENT FROM ELECTRON INJECTIONS IN BETATRON. V. N. Logunov, E. P. Ovchinnikov, et al (Lebedev Moscow Inst. of Physics). Zhur. Tekh. Fiz. 27, 43-8(1957) May. (In Russian)

Studies were made of electron capture in a synchrotron with a betatron starter to determine the size and shape of a current occurring in the chamber at the injection moment with respect to the size and shape of injection pulse, the position of the pulse in respect to the capture area, and to the injector current emission. A scheme is given of the recording apparatus with high resolving power and the block system of the installation. (R.V.J.)

10333

DEPENDENCE OF BREMSSTRAHLUNG INTENSITY IN A BETATRON ON THE INJECTION PARAMETERS. V. N. Logunov, E. P. Ovchinnikov, and V. D. Rusanov (Lebedev Moscow Inst. of Physics). Zhur. Tekh. Fiz. 27, 1132-42 (1957) May. (In Russian)

Studies were made of the effective electron capture and the effects of injector pulse shape on the performance of accelerators. The analysis of the curve showed the absence of uniform capture mechanism in the working conditions of a betatron. A noncollective mechanism of capture stabilized by the adiabatic changes in magnetic fields was observed for low currents while for currents at working range appeared a collective mechanism of capture which also determined the effectiveness of the injection in currents at operating range. In betatron construction it is desirable to achieve the injection pulse shape parameter with a slowly rising front and sharply falling trailing edge. (R.V.J.)

RADIATION ABSORPTION AND SCATTERING

10334 NAA-SR-Memo-236

North American Aviation. [Inc., Downey, Calif.]

TRANSPORT MEAN FREE PATH OF THERMAL NEUTRONS IN HEAVY WATER. D. C. Woods. Feb. 29, 1952. Decl. Feb. 15, 1956. 9p. $1.80(ph OTS); $1.80(mf OTS).

Measurements of neutron flux distributions for various natural uranium–heavy water lattices were correlated with the available nuclear data. Results showed that the value λ_t (the transport mean free path) is higher than the commonly used value of 2.4 cm. Additional experiments found it consistent with a higher value of λ_t. Investigations were made of the "linear" extrapolation method used in measuring λ_t. (R.V.J.)

10335

RESONANCE ABSORPTION OF NEUTRONS IN METAL AND OXIDE CYLINDERS. Monte V. Davis (General Electric Co., Richland, Wash.). Nuclear Sci. and Eng. 2, 488-91(1957) July.

Reactivity measurements on cadmium-clad cylinders of uranium, uranium oxide, thorium, and thorium oxide have been interpreted to yield the following effective resonance integrals. For cylinders all with radii of 1.73 cm and with the listed densities:

Sample	Density (g/cm^3)	Effective resonance integral (barns)
Uranium	18.9	10.9
Uranium oxide (UO_2)	7.96	14.0 ± 0.9
Thorium	11.5	9.2 ± 0.3
Thorium oxide (ThO_2)	9.64	12.1 ± 0.8

The results are corrected for nonresonance absorptions of neutrons at energies above cadmium cutoff. (auth)

10336

SCATTERING PROBLEMS IN FIELD THEORY. A. Visconti and H. Umezawa (Univ. of Manchester). Nuovo cimento (10) 4, Suppl. No. 2, 829-31(1956).

The expression for the solution of an S-matrix scattering problem: $S = \Sigma g^n S_n$ in terms of the power of the coupling constant (perturbation series) cannot be applied for large values of g. Therefore, an approximation method is investigated in which the terms $g^n S_n$ is replaced by $\sum_{\rho=0}^{n} \times_{\rho}^{(n)} S_{n-\rho}$ where the constants $\times_{\rho}^{(n)}$ are functions of g. This is done by a reformulation of Fredholm's method. (M.H.R.)

10337

IONIZATION AT THE ORIGIN OF HIGH ENERGY ELECTRON POSITRON PAIRS. G. Yekutieli (Weizmann Inst. of Science, Rehovoth, Israel). Nuovo cimento (10) 5, 1381-7(1957) June.

The ionization at the origin of a high-energy (E > 50 Bev) electron-positron pair is calculated, and the results are compared with experiment. (auth)

10338

THE ENERGY DISTRIBUTION OF THE INELASTIC SCATTERING OF K^+ MESONS IN NUCLEI. P. Mittelstaedt (Max-Planck-Inst. fur Physik, Göttingen, Germany). Nuovo cimento (10) 5, 1480-96(1957) June. (In German)

The energy distribution in the inelastic scattering of K^+ mesons by complex nuclei is calculated using the Goldberger method. The results are found to be in fair agreement with the 80 Mev experimental data of the Göttingen group. (auth)

10339

INELASTIC SCATTERING OF ELECTRONS BY NUCLEI. L. J. Tassie (Australian National Univ., Canberra). Nuovo cimento (10) 5, 1497-1509(1957) June.

It is shown that the variation with energy of the differential cross section for the scattering of high-energy electrons by nuclei depends on whether the nuclear transition occurs with $\Delta M = 0$ or with $\Delta M = \pm 1$, where M is the component of the nuclear spin in the direction of the vector change of momentum of the scattered electron. The electron excitation of $\Delta M = 0$ transitions is then considered using the independent particle model of the nucleus, and comparison is made with experimental results for C^{12}. (auth)

10340

LOW ENERGY K-NUCLEON INTERACTION. D. Amati and B. Vitale. Nuovo cimento (10) 5, 1533-9(1957) June.

The low-energy K-nucleon interaction has been studied using the Salam interaction Hamiltonian for the Nucleon-Heavy Meson-Hyperon system. The K-N scattering amplitude has been calculated disregarding $\bar{K}$ virtual state contributions, recoil, and virtual barion-antibarion pair effects. Results are rather independent of the cut-off energy η. The experimental data on K^+-N scattering cross sections are obtained with a renormalized coupling constant $G^2/4\pi = 0.3$. With this choice for the coupling constants, the phase shifts are small and negative for the $T = 0$ isobaric spin eigenstate and rather larger and positive for the $T = 1$ eigenstate. (auth)

10341

POLARIZATION IN NEUTRON PROTON SCATTERING AT 95 Mev. G. H. Stafford, C. Whitehead, and P. Hillman (Atomic Energy Research Establishment, Harwell, Berkshire). Nuovo cimento (10) 5, 1589-97(1957) June.

The free neutron-proton polarization has been measured at center-of-mass angles from 20° to 160°. The asymmetries were obtained using fixed detectors and by rotating the plane of polarization of the neutron beam with respect to the scattering plane by means of a long solenoid. The polarization cross section was found to be strongly non-antisymmetrical about 90° center-of-mass, and evidence for D-wave interaction was obtained. (auth)

10342

ON THE MEASUREMENTS OF THE PION-PROTON ELASTIC SCATTERING IN NUCLEAR EMULSIONS. G. Ferrari, E. Manaresi, and G. Quareni. Nuovo cimento (10) 5, 1651-7(1957) June.

The scanning methods for the photographic emulsions, used in the study of the pion-proton elastic scattering, are discussed. A particular method is described, which is useful in the research of the backwards scatterings ($135° < \theta_{c.m.} \leq 180°$). It has been employed in order to detect some eventual contribution of waves with $l > 1$, by analyzing the behavior of $d\sigma/d\Omega$ in this angular interval. The analysis of $d\sigma/d\Omega$ for the scattering process $\pi^+ + p$ at 120 Mev, based on 871 events, shows that no wave with $l > 1$ is present in a measurable quantity. The phase shifts of the S and P waves result: $\alpha_3 = -10.3 \pm 2.9$; $\alpha_{33} = 31.8 \pm 1.6$; $\alpha_{31} = -2.6 \pm 1.6$. (auth)

10343

π^+-PROTON SCATTERING AT 100 Mev. R. Gessaroli, G. Quareni, G. Dascola, S. Mora, and G. Todesco. Nuovo cimento (10) 5, 1658-9(1957) June.

The differential cross section $d\sigma/d\Omega$ for the elastic process $\pi^+ + p$ at 100 Mev has been measured. 621 events were found in photographic emulsion. The phase-shift analysis gives the following values for the S and P waves: $\alpha_3 = -10.6 \pm 1.9$; $\alpha_{33} = 21.7 \pm 1.2$; $\alpha_{31} = -2.5 \pm 1.3$. (auth)

10344

π^+-PROTON SCATTERING AT 83 Mev. L. Ferretti, G. Quareni, M. Della Corte, and T. Fazzini. Nuovo cimento (10) 5, 1660-2(1957) June.

In photographic emulsion 274 events $\pi^+ + p = \pi^+ + p$ have been found. The energy of the pions extends between 70 and 90 Mev; the mean energy is 83 Mev. The phase-shift analysis gives, for the S and P waves, the following values: $\alpha_3 = -12.3 \pm 2.9$; $\alpha_{33} = 12.0 \pm 2.2$; $\alpha_{31} = -3.1 \pm 1.0$. (auth)

10345

COLLISION MATRIX FOR ROTATIONAL EXCITATION IN THE ADIABATIC APPROXIMATION. David M. Chase (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 106, 516 (1957) May 1.

An expression is given for the collision matrix for rotational excitation of an axially symmetric scatterer in terms of the collision matrix for the related elastic scattering problem in the adiabatic approximation. (auth)

10346

INELASTIC SCATTERING OF SLOW NEUTRONS BY LATTICE VIBRATIONS IN ALUMINUM. R. S. Carter, H. Palevsky, and D. J. Hughes (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 106, 1168-74(1957) June 15.

The lattice vibrations of Al have studied by means of the inelastic scattering of cold neutrons, in which the neutron absorbs a phonon whose energy is typically much larger than the incident neutron energy. Neutrons with a wavelength about 5A were obtained by filtering a beam of thermal neutrons through eight inches of Be. After scattering in an Al single crystal, the neutron energy distribution was determined by time of flight, using a mechanical chopper. The peaks observed in the energy distribution of the scattered neutrons for various crystal orientations were used to determine the "scattering surface" in a plane parallel to one face of the cubic lattice. The scattering surface gives the dispersion law for the crystal, that is, the frequency, ω, of the lattice vibration phonons as a function of the wave vector, q. Dispersion curves, obtained for three different directions in the crystal, agree well with x-ray results and with theoretical calculations of the dispersion based on the assumption of harmonic forces. (auth)

10347

ANALYSIS OF PROTON-NUCLEUS SCATTERING AT 9.8 Mev. A. E. Glassgold, W. B. Cheston, M. I. Stein, S. B. Schuldt, and G. W. Erickson (Univ. of Minnesota, Minneapolis). Phys. Rev. 106, 1207-14(1957) June 15.

Studies of nuclear scattering from an arbitrary complex central potential have been initiated. This first report is devoted to the analysis of proton-nucleus scattering at 9.8 Mev using the Saxon potential. Qualitative rules for the dependence of the cross section on the parameters of this model are presented for medium-heavy elements. An important feature of the analysis is that more than one set of optical model parameters is possible at this energy. These multiple solutions have in common approximately the same value of VR^2, where V is the real part of the nuclear potential and R is the interaction radius. This value does not differ significantly from the value used in the nuclear shell model. The imaginary part of the nuclear potential corresponds to an absorption length of about one nuclear radius. (auth)

10348

ELASTIC SCATTERING OF ALPHA PARTICLES WITH THE OPTICAL MODEL. W. B. Cheston and A. E. Glassgold (Univ. of Minnesota, Minneapolis). Phys. Rev. 106, 1215-19(1957) June 15.

The scattering of medium-energy alpha particles by nuclei has been examined with the optical model. It is possible to reproduce the detailed features of the experimental data with such a model. An examination of the approximate models suggested by other authors is presented. Some features of the data can be understood on the basis of a one-parameter black nucleus model (i.e., the Blair model) interpreted quantum-mechanically. However, the requirement of detailed fit to the experimental data requires a model with more parameters. The blackness of nuclear matter to alpha particles causes the scattering cross section to be insensitive to the real part of the alpha-particle—nucleus interaction. (auth)

10349

ANGULAR CORRELATIONS IN THE TWO-PHOTON COMPTON EFFECT. R. B. Theus and L. A. Beach (Naval Research Lab., Washington). Phys. Rev. 106, 1249-52(1957) June 15.

The angular correlation between the two photons emitted in two-photon Compton scattering of Co^{60} gamma radiation was observed to be in good agreement with theoretical predictions. Coincidence data were obtained for scattering angles of 40 and 60° as a function of the azimuthal angle between the two scattered photons. (auth)

10350

ANGULAR DISTRIBUTION OF 424-Mev POLARIZED PROTONS ELASTICALLY SCATTERED FROM VARIOUS NUCLEI. Edvard Heiberg (Univ. of Chicago, Ill.). Phys. Rev. 106, 1271-9(1957) June 15.

Measurements have been made of the polarization and the angular distribution of 424-Mev protons elastically scattered from C, Al, Fe, and Ag. The results clearly indicate the importance of separating the elastic scattering from scattering involving excited states of the nucleus. By the inclusion of inelastic scattering, the dips in the cross-section curves and the details in the polarization curves get smeared out. The C data show reasonable agreement with similar work by Chesnut. Elastic cross sections were estimated by extrapolating the differential cross-section curves to zero degrees using the optical model of the nucleus. A nuclear radius was calculated from the location of the first diffraction minima in the cross section curves for the various elements. Upon using the optical model, an average value $r_0 = 1.03 \times 10^{-13}$ cm was obtained. The Born approximation gave $r_0 = 1.2 \times 10^{-13}$ cm. (auth)

10351

LONGITUDINAL POLARIZATION OF BREMSSTRAHLUNG AND PAIR PRODUCTION AT RELATIVISTIC ENERGIES. Kirk W. McVoy (Brookhaven National Lab., Upton, N. Y.) and Freeman J. Dyson (Columbia Univ., New York). Phys. Rev. 106, 1360-1(1957) June 15.

A simple argument is given which determines the cross sections for bremsstrahlung and pair production with specified longitudinal polarization for the incident and outgoing particles, when energies of all the particles concerned are highly relativistic. (M.H.R.)

10352

ON COLLIMATION CORRECTION FOR LOW-ANGLE X-RAY SCATTERING. V. N. Filipovich (Leningrad Chemical Inst. of Silicates). Zhur Tekh. Fiz. 27, 1029-44 (1957) May.

A new method is offered for setting up the problem for collimation correction with systematic application of the φ function. The solution is given for the problem of rectangular slit and homogeneous incident beam, and the simplified correction for the problem is included. General observations were made of the interferring maximum displacement with respect to smaller angles appearing with the elongation of the slit and the possibility of elimination of the maximum with the width expansion. (R.V.J.)

RADIATION EFFECTS

10353 IDO-16337

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

RADIATION DAMAGE STUDIES PROGRAM; ETR LOOP MATERIALS PROGRESS REPORT. M. S. Robinson. Apr. 19, 1957. 22p. Contract AT(10-1)-205. $0.20(OTS).

The design of experimental loops for the ETR has required the consideration of some structural metals for which there is little engineering data concerning the change of mechanical properties with neutron irradiation. Samples of these materials have been obtained, and sub-size impact and tensile samples are now being irradiated in the MTR. From these samples changes in such properties as tensile strength, hardness, ductility, corrosion resistance and impact strength will be determined. The first group of tensile samples, consisting of: Hastelloy-X, Zircalloy-2, 410 Stainless Steel, 2¼ Croloy, and Inconel-X, has been tested in the MTR hot cell. The 2¼ Croloy, which was nickel plated before reactor insertion, corroded too much to permit further reactor testing. Test data for the other materials and photographs of the samples are presented. (auth)

10354

EFFECTS OF IRRADIATION ON SOME CORROSION-RESISTANT FUEL ALLOYS. J. H. Kittel, S. Greenberg, S. H. Paine, and J. E. Draley (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, 431-49(1957) July.

Three corrosion-resistant uranium-base alloys, U–3 wt. % Nb, U–5 wt. % Zr–1.5 wt. % Nb, and U–3.8 wt. % Si (U_3Si) were irradiated to burnups of 0.1 at. % or less. Observations were made of irradiation-induced length changes in specimens of the alloys as influenced by the method of fabrication and heat treatment, and of changes in aqueous corrosion resistance resulting from irradiation. It was found that the uranium–niobium alloy was unsuitable from the standpoint of dimensional and surface stability, and its corrosion resistance was destroyed by irradiation. The uranium–zirconium–niobium alloy could be nominally stabilized under irradiation, and its corrosion resistance was destroyed by between 0.046 and 0.074 at. % burnup. The uranium–silicon alloy was relatively stable under irradiation and showed no increase in corrosion rate at 290°C after 0.090 at. % burnup, although cracking occurred after several days corrosion testing. (auth)

RADIOACTIVITY

10355

POLARIZATION OF ELECTRONS EMITTED BY Sr^{90}. Helene Langevin-Joliot, Nadine Marty, and Pierre Sergent. Compt. rend. 244, 3142-4(1957) June 24. (In French)

The negative polarization of electrons emitted by Sr^{90} ($\Delta J = 2$) is placed in evidence by electrostatic deflection of electrons followed by a diffusion in gold leaf. (tr-auth)

10356

LOCALIZATION OF RADIOACTIVE AND STABLE HEAVY NUCLIDES IN OCEAN SEDIMENTS. G. Arrhenius and M. N. Bramlette (Scripps Inst. of Oceanography, La Jolla, Calif.) and E. Picciotto. Nature 180, 85-6(1957) July 13.

Preliminary data from the radiometric analysis of ocean sediments indicate that ionium, produced from U^{234} in solution in sea water, together with other thorium isotopes, the rare-earth elements and a number of other heavy elements are carried to the sediment and sorbed to the surface of the micro-crystalline apatite of skeletal debris. (C.H.)

10357

RADIATION FROM ^{192}Pt AND PROPOSED DECAY SCHEME. M. S. Huq (Dacca Univ., East Pakistan). Nuovo cimento (10) 5, 1456-62(1957) June.

By bombarding a gold target at proton energy of 61 Mev the isotopes Pt^{192} and Pt^{191} were indirectly produced. Photographs were taken with the help of a 180° focussing β-ray spectrograph. Of the 207 lines examined, 170 were identified. Those assigned to Pt^{192} and Pt^{191} are given in separate tables. Assignments were aided by intensity measurements under the high resolution of a 180° β-ray spectrometer with crystal detector. A tentative decay scheme for Pt^{192} was also made. (auth)

10358

ON THE NEUTRON DEFICIENT ISOTOPES OF THALLIUM, ^{200}Tl AND ^{202}Tl. R. K. Gupta and S. Jha (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10) 5, 1524-7(1957) June.

The scintillation spectrometer studies of Tl^{200} have shown that this isotope emits, in addition to the γ rays reported by Gerholm, γ rays of energy around 1,580 kev, 1,680 kev, 1,800 kev, 1,950 kev and 2,100 kev. In the study of Tl^{202}, the ratio of the probabilities of L electron captures and K electron captures has been measured by the summing technique. The ratio P_L/P_K, leading to the 440-kev state, is $0.555^{+0.036}_{-0.033}$, from which the total decay energy has been calculated to be 600^{+5}_{-7} kev. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

10359

ELECTRICAL RESISTIVITIES AND PHASE TRANSFORMATIONS OF LANTHANUM, CERIUM, PRASEODYMIUM, AND NEODYMIUM. F. H. Spedding, A. H. Daane, and K. W. Herrmann (Iowa State Coll., Ames). J. Metals 9, 895-7 (1957) July.

The electrical resistivities of high-purity La, Ce, Pr, and Nd were investigated as a function of temperature over the range from room temperature to near the melting points of the metals. Transformation temperatures were observed in these metals which were confirmed by supplementary x-ray-diffraction studies. (auth)

10360

THE COULOMB EXCITATION OF Eu^{151} AND Eu^{153}. C. M. Class and U. Meyer-Berkhout (Univ. of Copenhagen). Nuclear Phys. 3, 656-69(1957) July.

The low lying states of Eu^{151} and Eu^{153} to which transitions occur by means of Coulomb excitation have been studied by observing the spectra of the internal conversion electrons. Thin targets prepared from isotopically enriched Eu oxide were bombarded with protons and alpha particles in the energy range between 2 and 4 Mev. The measurements on Eu^{153} confirmed the existence of the previously reported rotational levels at 83 and 190 kev and yield improved values of the reduced transition probabilities. The transitions observed in Eu^{151} were found to fit conveniently into a level spectrum having states at 20, 193, and 304 kev. The first of these levels is known also from the beta decay of Sm^{151}. The 304 kev level decays principally by an M1 transition to the ground state with relatively weaker transitions to the 193 and 20 kev levels. The 193 kev level undergoes transitions to the ground state only, by predominantly E2 radiation. The values of $B(E2)/e^2$ for excitation of the 193 and 304 kev levels were found to be 0.14×10^{-48} cm^4 and 0.40×10^{-48} cm^4, respectively. (auth)

10361

THE LOW-LYING ENERGY LEVELS OF ^{151}Eu. A. Bisi, E. Germagnoli, and L. Zappa. Nuclear Phys. 3, 670-8 (1957) July.

The radioactive decay of Gd^{151} has been investigated. Measurements of electron conversion spectrum and γ spectrum show the existence of γ rays accompanying the electron capture process. The energies of the γ rays were found to be 21.3, 80, (144), 155, 176, 240, 299 kev. A decay scheme is proposed. (auth)

10362

THE THERMAL AND MAGNETIC PROPERTIES OF YTTERBIUM ETHYL SULPHATE BETWEEN 20°K AND 1°K. A. H. Cooke, F. R. McKim, H. Meyer, and W. P. Wolf (Oxford Univ.). Phil. Mag. (8) 2, 928-35(1957) July.

The susceptibility of a single crystal of $YbEtSO_4$ has been measured between 20 and 1°K. Below 4°K the results obeyed the relations $\chi_{||} = 1.08/T$ per mol, and $\chi_{\perp} = 0.061_5$ per mol. These measurements served to identify the ground doublet state of the Yb ion in this case as $|J = {}^7/_2, J_z = \pm {}^3/_2\rangle$. The magnetic specific heat was measured at five temperatures between 3 and 1°K by the relaxation method. The results were given by $CT^2/R = 4.34 \times 10^{-4}$, in agreement with calculations based on dipole–dipole and hyperfine interactions alone. The spin lattice relaxation time τ was also measured. At 3°K, $\tau \simeq 5 \times 10^{-4}$ sec and was very temperature dependent. Susceptibility measurements above 4°K indicated the population of excited states, which could not be unambiguously identified. Their separation from the ground state was at least 57°K. (auth)

10363

SOME NEW ISOMERIC TRANSITIONS IN RARE EARTH NUCLEI. J. W. Mihelich (Univ. of Notre Dame, Ind.) and B. Harmatz (Oak Ridge National Lab., Tenn.). Phys. Rev. 106, 1232-5(1957) June 15.

The following isomeric transitions have been observed in neutron-deficient rare earth isotopes: Tb^{156m} (5.5 hr) 88.2 kev (E3); Ho^{160m} (5.0 hr) 60.1 kev (E3); Er^{167m} (2.5 sec) 208 kev (E3); Er^{168m} (10^{-7} sec); and Yb^{171m} ($T_{1/2}$?) 75.8 kev (E3). All the E3 transitions may proceed between levels predicted by Mottelson and Nilsson. (auth)

10364

ENERGY LEVELS IN RARE-EARTH IONS. J. P. Elliott and W. A. Runciman (Atomic Energy Research Establishment, Harwell, Berks) and B. R. Judd (Univ. of Oxford). Proc. Roy. Soc. (London) A240, 509-23(1957) July.

The tensor-operator and group-theoretical methods of Racah are used to examine the following contributions to the Hamiltonian of a rare-earth ion: the Coulomb interaction between the electrons, the spin-orbit coupling of the electrons, and the term arising from the influence of an external electrostatic field such as occurs when the rare-earth ion is situated in a crystal lattice. The positions of all the terms of the configurations f^2, f^3 and f^4, as well as all the terms of other configurations f^n whose multiplicities are the highest or the highest but one, are tabulated on the basis of a hydrogenic 4f wave function. The parameter λ defining the spin-orbit splitting of a term is given for all terms whose energies have been found. (auth)

SHIELDING

10365 NP-6335

Naval Radiological Defense Lab., San Francisco.
PROCEEDINGS OF THE SHIELDING SYMPOSIUM HELD

AT THE NAVAL RADIOLOGICAL DEFENSE LABORATORY, OCTOBER 17-19, 1956. Volume 1. Reviews and Lectures No. 29. Feb. 1, 1957. 268p.

Unclassified papers on radiation shielding requirements associated with the development and use of nuclear weapons are presented. Both theoretical studies and experimental measurements of radiation emission and attenuation are included. Special consideration is given to fall-out radiations and the shielding of military facilities. (D.E.B.)

SPECTROSCOPY

10366 AEC-tr-2939

THE TENTH USSR CONFERENCE OF SPECTROSCOPY; MEETINGS AND CONFERENCES. G. S. Landsberg. Translated from Priroda 45, 43-7(1956). 13p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 11-3621.

10367

ON THE USE OF A DIFFERENCE TYPE ELECTROSTATIC FIELD IN SPECTROSCOPY OF CHARGED PARTICLE BEAMS. M. I. Korsunskiĭ and V. A. Bazakutsa (Lenin Kharkov Polytechnic Inst.). Doklady Akad. Nauk S.S.S.R. 113, 1029-31(1957) Apr. 11. (In Russian)

Properties of difference-type fields were studied with a specially designed analyzer with charged particle beam turned under 27° angle. The analyzer had the equilibrium radius r_0 = 200 mm, the coefficient of the field heterogeneity $\eta = 1/4$, the distance varied in accordance with the Berber's generalized rule. The charged particle beam consisted of electrons shot from an electron-ray tube and was supplied by stabilized voltage. The experiments with difference-type fields confirmed the possibility of an improved compact illuminating electrostatic analyzer with a strong resolving power and high dispersion. The combination of difference-type electrostatic fields and heterogeneous magnetic fields of difference type showed the feasibility for construction of a luminous mass spectrometer with double focusing and strong resolving power. (R.V.J.)

10368

AUTOMATIC BRIDGE BALANCE FOR NUCLEAR SPIN RESONANCE SPECTROMETER. R. L. Collins (Phillips Petroleum Co., Bartlesville, Okla.). Rev. Sci. Instr. 28, 502-3(1957) July.

Troublesome changes of the bridge balance in a twin-T nuclear resonance bridge have been eliminated by the application of a voltage-sensitive condenser. A small amplitude, high-frequency modulation voltage applied to the condenser senses any deviation from balance, and a servo loop provides a d-c correction voltage which maintains the bridge balance. No apparent deterioration of the spectrum results from modulation of the bridge. (auth)

10369

FIELD STABILIZER FOR HIGH-RESOLUTION NUCLEAR MAGNETIC RESONANCE. H. Primas and Hs. H. Gunthard (Swiss Federal Inst. of Tech., Zurich). Rev. Sci. Instr. 28, 510-14(1957) July.

Theory of design and construction of a field stabilizer for high-resolution nuclear magnetic resonance spectrometers is described. Achievable time stability is $1:10^8$. A voltage induced by field variations in suitably located coils is amplified by a galvanometer amplifier, integrated, and fed back to a system of coils biasing the field. The feedback ratio is 70 db from d-c up to 0.2 cps. The stabilizer allows measurement of nuclear magnetic resonance signals with resolution of 10^8 under field conditions, independent of field fluctuations produced by temperature variations and stray fields. (auth)

10370

HIGH RESOLUTION NEUTRON VELOCITY SPECTROMETER WITH BETATRON SOURCE. M. L. Yeater and E. R. Gaerttner (Knolls Atomic Power Lab., Schenectady, N. Y.) and G. C. Baldwin (General Electric Research Lab., Schenectady, N. Y.). Rev. Sci. Instr. 28, 514-24(1957) July.

A neutron velocity spectrometer with a 100-Mev betatron as a source of neutron pulses has been in use at the Knolls Atomic Power Laboratory since 1953, for cross section measurements up to about 50,000 ev. An internal, thick U target is bombarded by 80-Mev electrons when the betatron orbit is rapidly contracted, giving approximately 0.1-microsecond bursts of neutrons at a 60-pps repetition rate with a peak intensity of about 7×10^{15} neutrons per second. Measurements of total, capture, and fission cross sections are made with high-resolution detecting equipment located at points up to 20 meters from the target. The timing, registering, and data-processing techniques are designed to achieve maximum benefit from the short burst duration. (auth)

10371

MEASURING REFRACTIVE INDEX OF PLASTIC FILMS. R. Hobart Ellis, Jr. (Columbia Univ., New York). Rev. Sci. Instr. 28, 557-8(1957) July.

By a method of successive approximation the index of refraction of polystyrene films has been determined from two photographs of continuous spectra. It is shown that the method is valid if the dispersion is known within several percent as a starting assumption. (auth)

THEORETICAL PHYSICS

10372

NONLINEAR ELECTROMAGNETISM AND PHOTONS. Florence Destouches-Aeschlimann. Compt. rend. 244, 3034-6(1957) June 17. (In French)

Starting with nonlinear equations for physical waves of a photon obtained by fusion, nonlinear equations of electromagnetism were derived. (T.R.H.)

10373

ABOUT THE FUNDAMENTAL RELATIVISTIC INVARIANT EQUATION FOR A PARTICLE WITH ½ SPIN. G. A. Zaĭtsev. Doklady Akad. Nauk S.S.S.R. 113, 1248-50(1957) Apr. 21. (In Russian)

Considering that the Dirac equation cannot be applied to arbitrary particles with ½ spin, calculations were developed to find the relativistic invariant equations for particles with ½ spin, charge e, mass m_0, and magnetic moment $\mu_0 = (e\hbar/2M\,C)(1 + \delta)$, (where $\delta = 0$), located in the outer electromagnetic field. (R.V.J.)

10374

ON THE IMPOSSIBILITY OF THE HAMILTONIAN FORMULATION OF THEORY WITH THE FORM-FACTOR. V. S. Barašenkov (Joint Inst. for Nuclear Research, Dubna, USSR). Nuovo cimento (10) 5, 1469-79(1957) June.

It is shown that the Hamiltonian structure is not proper to the theory with nonlocal interaction; the latter may be formulated, however, both in Lagrangian x_k; $\dot{x}_k$; A_μ; $\dot{A}_\mu$ and Hamiltonian variables x_k; P_k; A_μ; π_μ. With the help of an example of one-dimensional oscillator Pauli's method is considered. The initial integro-differential equation of motion and the canonical system of equations of motion obtained by the Pauli method are not equivalent. The many-time equations of motion obtained by Hayashi's method turn out to be incompatible in any K-approximation of the perturbation theory. (auth)

10375

VELOCITY-DEPENDENT NUCLEAR INTERACTION. W. E. Frahn and R. H. Lemmer (National Physical Re-

search Lab. C.S.I.R., Pretoria, South Africa). Nuovo cimento (10) 5, 1564-72(1957) June.

The single-particle wave equation describing the motion of nucleons in nuclei, as derived from the nuclear many-body problem, is of a nonlocal form in coördinate space. It is shown that in the effective mass approximation this equation reduces to a velocity-dependent Schrödinger equation, which contains a spatially variable effective nucleon mass in a properly symmetrized kinetic energy operator. The eigenvalue problem is treated for the special case of the infinite harmonic oscillator potential as the local part of the interaction. (auth)

10376

A MODEL FOR THE WEAK INTERACTIONS. S. Gotō (Tokyo Gakugei Univ., Japan). Nuovo cimento (10) 5, 1573-88(1957) June.

By assigning iso-spin to be zero and strangeness u to be 2, −2, and 0 for the leptrons μ^+, e^-, and ν, respectively, the universality of the weak interactions, including the lepton processes, is shown to be consistently derived if the strong primary interactions are assumed to be of the Yukawa type and the weak primary interactions of the Fermi one. (auth)

10377

ON THE RELATION BETWEEN THE LEE MODEL AND ORDINARY MESON THEORY. G. F. Dell'Antonio and F. Duimio. Nuovo cimento (10) 5, 1636-45(1957) June.

Some features of a possible generalization of the Lee model are examined. It is shown that it can be considered as an approximation of the neutral scalar meson theory with fixed sources, obtained by introducing a cut-off on the total energy of the mesons. (auth)

10378

ON THE EQUIVALENCE THEOREM FOR THE MASSLESS NEUTRINO. L. A. Radicati and B. Touschek. Nuovo cimento (10) 5, 1693-9(1957) June.

A new proof is presented of the Serpe-Fierz equivalence theorem for the free neutrino case. The interaction of neutrinos with their sources is seen to restrict the freedom in the neutrino description. It is proved that the only two state theory for the neutrino which does not give rise to double β decay is the Weyl-Lee-Yang theory. (auth)

10379

GRAVITATIONAL FORCES AND QUANTUM FIELD THEORY. P. Gulmanelli and E. Montaldi. Nuovo cimento (10) 5, 1716-21(1957) June.

The Gamow-Teller hypothesis, according to which an exchange of neutrino pairs could give rise to a gravitational type potential between nucleons, is re-examined. By introducing a new boson field it is shown that this guess cannot be valid at least in the frame of the usual linear field theories. (auth)

10380

THE NUCLEAR POTENTIAL FOR THE K^+-MESONS. C. Marchi, G. Quareni, A. Vignudelli, G. Dascola, and S. Mora. Nuovo cimento (10) 5, 1790-2(1957) June.

10381

EIGENVALUES AND EIGENFUNCTIONS OF A BOSE SYSTEM OF HARD SPHERES AND ITS LOW-TEMPERATURE PROPERTIES. T. D. Lee (Columbia Univ., New York) and Derson Huang and C. N. Yang (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 106, 1135-45(1957) June 15.

It is shown that the pseudopotential method can be used for an explicit calculation of the first few terms in an expansion in power of $(\rho a^3)^{1/2}$ of the eigenvalues and the corresponding eigenfunctions of a system of Bose particles with hard-sphere interaction. The low-temperature properties of the system are discussed. (auth)

10382

CONTINUED FRACTION APPROXIMANTS TO THE BRILLOUIN-WIGNER PERTURBATION SERIES. R. C. Young and L. C. Biederharn (Rice Inst., Houston, Texas) and E. Feenberg (Washington Univ., St. Louis, Mo.). Phys. Rev. 106, 1151-5(1957) June 15.

The Brillouin-Wigner series for the energy is converted into a continued fraction. Refinements on the Brillouin-Wigner formulas developed in recent publications are identified with alternate ($E^{(n)}$) approximants to the continued fraction. A second sequence of approximants [$E^{(n+\frac{1}{2})}$] occurs between successive terms of the $E^{(n)}$ sequence. These are useful in calculations as shown by an illustrative example, but do not possess the extremum property which is a valued characteristic of the first sequence. A general proof is given that the approximants $E^{(n)}$ are invariant under the μ transformation defined and verified for n = 1, 2, and ∞ in an earlier publication. (auth)

10383

COMPOSITE PARTICLES OF ZERO MASS. K. M. Case (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 106, 1316-20(1957) June 15.

A neutrino theory of spin-zero particles of zero mass is constructed in terms of bilinear neutrino operators. The restrictions of a two-component neutrino theory are shown to reduce the possible fields from three to one. Further, by using a two-component neutrino theory it is shown that it is impossible by using bilinear expressions to form a theory of light and that using quadrilinear expressions cannot produce a theory of gravitation. (auth)

10384

BOSON FAMILY FROM QUANTIZED FINITE-PARTICLE MAXWELL THEORY. Richard Ingraham and Joseph Ford (Johns Hopkins Univ., Baltimore, Md.). Phys. Rev. 106, 1324-36(1957) June 15.

Quantization of finite-particle Maxwell theory yields a family of free bosons of nonzero masses and spins 1 and 0. The existence of a mass spectrum is a direct consequence of the new degree of freedom λ of particle size. These are quanta of short-range (meson) forces. The force-free theory (i.e., uncoupled to a fermion field) is studied here as a preliminary to the coupled case. An automatic connection with the Pauli-Villars regulator theory is obtained. The nature and position of the singularities in the field commutators of quantum electrodynamics and meson theory is profoundly altered. (auth)

TRITIUM AND TRITIUM COMPOUNDS

10385

NEUTRON SPECTRUM FROM T + t. S. J. Bame, Jr., and Wallace T. Leland (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 106, 1257-9(1957) June 15.

The energy spectrum of neutrons from the T + t reactions has been measured at 0° for a triton energy of 1.48 Mev. The energies of the neutrons extend from 0 to 12 Mev. A peak at the high-energy end at 11.3 Mev is ascribed to the $T(t,n)He^5$ reaction. No other peaks are observed within the counting statistics of the experiment. (auth)

URANIUM AND URANIUM COMPOUNDS

10386

PREPARATION OF ALPHA URANIUM SINGLE CRYSTALS BY A GRAIN-COARSENING METHOD. E. S. Fisher

(Argonne National Lab., Lemont, Ill.). J. Metals 9, 882-8 (1957) July.

A method for preparing single crystals of α uranium is described. The method depends on grain coarsening induced by the gradual decrease in grain growth inhibiting influence of dispersed inclusions in a fine grained recrystallized matrix. The factors which influence the tendency for this phenomenon and the size of coarse grains in U are described first. These factors are the bases for the method. However, to prepare single crystals of round cross section it is necessary to have the grain growth inhibiting inclusions distributed in a radial gradient increasing in quantity from the rod axis. This was accomplished by diffusion penetration of small concentrations of Si from the rod surface. The steps in the process which produced a number of single crystals 4 mm in diam by 5 to 10 mm long are outlined and discussed in the second part of the text. (auth)

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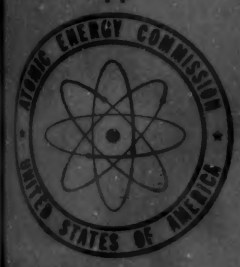

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